

May 1988

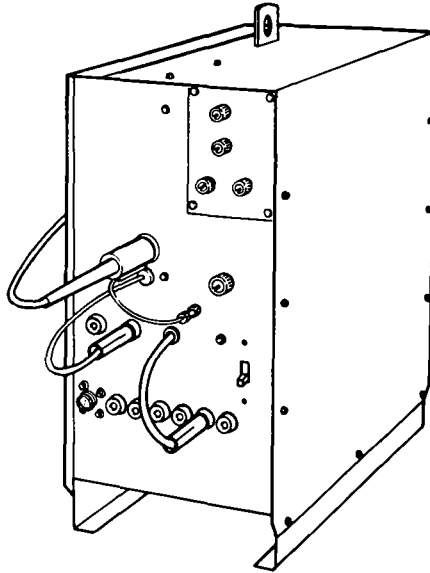
FORM: 113 336A

Effective With Serial No. JJ377166

IMPORTANT: Read and understand the entire contents of this manual, with special emphasis on the safety material throughout the manual, before installing, operating, or maintaining this equipment. This unit and these instructions are for use only by persons trained and experienced in the safe operation of welding equipment. Do not allow untrained persons to install, operate, or maintain this unit. Contact your distributor if you do not fully understand these instructions.

MODEL
AUTO ARC MW 4150
SPW 1

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OWNER'S MANUAL

AUTO ARC

MILLER ELECTRIC MFG. CO.

718 S. BOUNDS ST, P.O. Box 1079
APPLETON, WI 54912 USA

ADDITIONAL COPY PRICE 85 CENTS

NWSA CODE NO. 4579
PRINTED IN U.S.A.

ONE YEAR LIMITED WARRANTY

COVERAGE - Miller Electric Mfg. Co. warrants to the buyer who purchases this Auto Arc Welder ("Welder") for personal, family or household purposes ("Consumer") that this Welder will be free from defects in material and workmanship for a period of one year from the date of purchase. This warranty covers only the original purchaser of this Welder. Miller Electric does not authorize any party, including its authorized distributors, to offer any other warranty on behalf of Miller Electric. Upon expiration of the warranty period, Miller Electric shall have no further liability related to the Welder, except on warranty claims made during the warranty period.

THIS WARRANTY IS OFFERED IN LIEU OF ANY OTHER EXPRESS WARRANTY; AND, EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW, THE DURATION OF ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, IS LIMITED TO THE DURATION OF THIS WARRANTY.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Except as specified below, Miller's warranty does not apply to components having normal useful life of less than one (1) year, such as spot welder tips, relay and contactor points, parts that come in contact with the welding wire including nozzles and nozzle insulators where failure does not result from defect in workmanship or material.

Miller shall be required to honor warranty claims on warranted Equipment in the event of failure resulting from a defect within the following periods from the date of delivery of Equipment to the original user:

1. Arc welders, power sources, and components 1 year
2. Original main power rectifiers 3 years (labor - 1 year only)
3. All welding guns, feeder/guns and plasma torches . . . 90 days
4. Replacement or repair parts, exclusive of labor . . 60 days

WHAT IS NOT COVERED - This warranty does not extend to any Welder subjected to misuse, neglect, accident, or in-warranty repair by anyone except Miller Electric. Further, this warranty only extends to those purchasing the Welder for personal, family or household purposes. Commercial and industrial users are given a different warranty.

REMEDY FOR DEFECTIVE WELDER - Upon receipt of any defective Welder, Miller Electric will, at its option, repair or replace the defective Welder at its expense, refund or credit the purchase price (less reasonable depreciation based on actual use), or reimburse the Consumer for the cost of repair or replacement at an approved Miller Electric warranty station, provided that the purchaser of that Welder has followed the procedure for obtaining warranty performance set forth below. The Welder so repaired or used as a replacement will be shipped to the purchaser of the defective Welder, with transportation charges prepaid to any destination in the continental United States (transportation charges on shipments to Alaska or Hawaii will be paid only to the nearest port of export).

THE PURCHASER'S REMEDIES FOR A DEFECTIVE WELDER, TO THE EXTENT PERMITTED BY APPLICABLE LAW, ARE LIMITED TO THE REMEDY PROVIDED BY THIS WARRANTY; AND, TO THE EXTENT ENFORCEABLE UNDER APPLICABLE LAW, MILLER ELECTRIC SHALL IN NO EVENT BE LIABLE FOR CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES ARISING OUT OF THE USE OF, OR INABILITY TO USE, THE WELDER, WHETHER BASED ON BREACH OF THIS WARRANTY, MILLER ELECTRIC'S NEGLIGENCE OR OTHER TORT, OR ON ANY THEORY OF STRICT LIABILITY.

Some states do not allow the exclusion or limitation of consequential or incidental damages, so the above limitations may not apply to you.

PROCEDURE FOR OBTAINING WARRANTY PERFORMANCE

As soon as any defect in a Welder becomes known, the purchaser of the Welder must, within thirty (30) days, notify an approved Warranty Station or Miller Electric in writing of the defect. The purchaser must then, within the one year warranty period, return the Welder to Miller Electric at the following address:

Miller Electric Mfg. Co.
718 South Bounds Street
P.O. Box 1079
Appleton, Wisconsin 54912

All transportation charges to Warranty Station or Miller Electric must be prepaid.

MAY 26, 1988

FORM: 113336A

ERRATA SHEET

After this manual was printed, refinements in equipment design occurred. This sheet lists exceptions to data appearing later in this manual.

**	Part No.	Replaced With	Description	Quantity
4-25	004 988	121 015	DRIVE ASSEMBLY, wire (Eff w/JJ389988)	1
5-10	056 081	058 549	GUIDE, wire-inlet (Eff w/JJ389988)	1
		000 366	RING, retainer E (used on guide)	1
5-23	044 954	120 370	HOUSING, drive (Eff w/ JJ389988)	1

**First digit represents page no – digits following dash represent item no.

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

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ERRATA SHEET

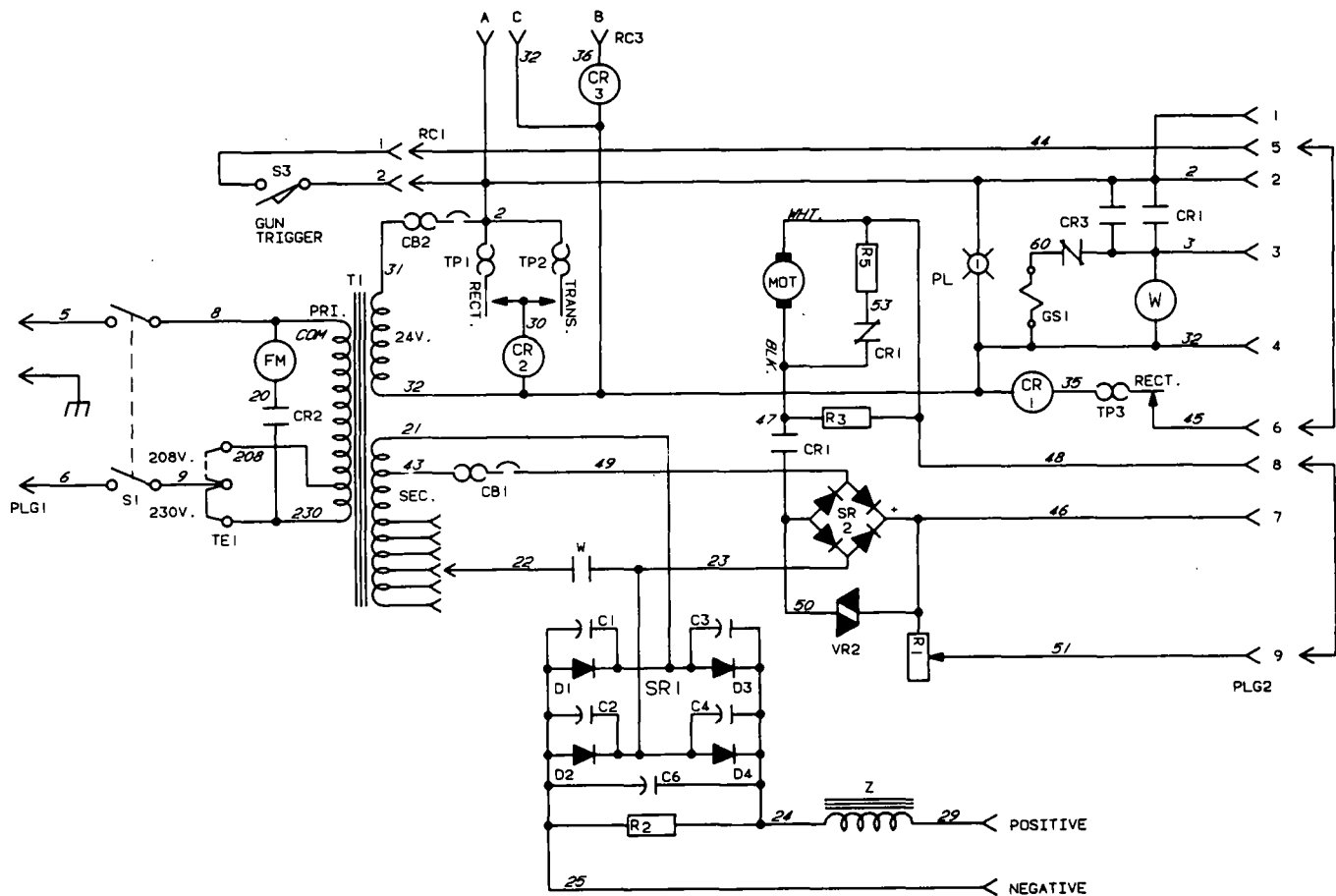
After this manual was printed, refinements in equipment design occurred. This sheet lists exceptions to data appearing later in this manual.

IMPORTANT: Replace all references to wire feed motor M with wire feed motor MOT.

AMENDMENT TO SECTION 6 – MAINTENANCE & TROUBLESHOOTING

Delete Section 6-9. RECTIFIER PROTECTION (Thermal Shutdown)

Amend Figure 6-4. Circuit Diagram For Welding Power Source



Circuit Diagram No. B-121 827

Figure 6-4. Circuit Diagram For Welding Power Source Effective With Serial No. JJ421795

**	Dia. Mkgs	Part No.	Replaced With	Description	Quantity
2-4	PLG2	008 073	Deleted	(Eff w/JJ421795)	
2-17		057 511	034 260	LINK, connector-contactors	2
4-21	VR2	082 722	082 722	VARISTOR (qty chg) (Eff w/JJ421795)	1
4-23	SR2	035 914	035 914	RECTIFIER (qty chg) (Eff w/JJ421795)	1
4-25		044 988	120 663	DRIVE ASSEMBLY, wire (Eff w/JJ377166)	1
4-25		120 663	121 014	DRIVE ASSEMBLY, wire (Eff w/JJ377167 thru JJ421794)	1
4-25		121 014	122 192	DRIVE ASSEMBLY, wire (Eff w/JJ421795 & on)	1
4-28		010 014	010 145	CLAMP, 1/2 dia	2
5-10		056 081	058 549	GUIDE, wire-inlet (Eff w/JJ389988)	1
			000 366	RING, E retainer (used on guide)	1
5-13	M	093 153	119 040	MOTOR, gear (Eff w/JJ421795)	1
5-22		044 954	120 370	HOUSING, drive roll (Eff w/JJ389988)	1
8-8		083 917	119 191	PANEL, front (Eff w/JJ377166)	1
8-23		023 083	600 318	CABLE, weld-stranded No. 3 (order by ft) (Eff w/JJ389988)	4 ft
9-		112 770	Deleted		
		112 772	Deleted		
		112 768	Deleted		
	RC3		073 383	RECEPTACLE, 3 socket MS-3102A-14S-1S (Eff w/JJ421795)	1
	CR3		006 393	RELAY, enclosed 24 volts ac DPDT	1
			058 553	GEAR, drive roll (Eff w/JJ377166)	1

**First digit represents page no - digits following dash represent item no.

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

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■SECTION 1 - SAFETY RULES FOR OPERATION OF ARC WELDING POWER SOURCE■

1-1. INTRODUCTION - We learn by experience. Learning safety through personal experience, like a child touching a hot stove is harmful, wasteful, and unwise. Let the experience of others teach you.

Safe practices developed from experience in the use of welding and cutting are described in this manual. Research, development, and field experience have evolved reliable equipment and safe installation, operation, and servicing practices. Accidents occur when equipment is improperly used or maintained. The reason for the safe practices may not always be given. Some are based on common sense, others may require technical volumes to explain. It is wiser to follow the rules.

Read and understand these safe practices before attempting to install, operate, or service the equipment. Comply with these procedures as applicable to the particular equipment used and their instruction manuals, for personal safety and for the safety of others.

Failure to observe these safe practices may cause serious injury or death. When safety becomes a habit, the equipment can be used with confidence.

These safe practices are divided into two Sections: 1 - General Precautions, common to arc welding and cutting; and 2 - Arc Welding (and Cutting) (only).

Reference standards: Published Standards on safety are also available for additional and more complete procedures than those given in this manual. They are listed in the Standards Index in this manual. ANSI Z49.1 is the most complete.

The National Electrical Code, Occupational Safety and Health Administration, local industrial codes, and local inspection requirements also provide a basis for equipment installation, use, and service.

1-2. GENERAL PRECAUTIONS

Different arc welding processes, electrode alloys, and fluxes can produce different fumes, gases, and radiation levels. In addition to the information in this manual, be sure to consult flux and electrode manufacturers for specific technical data and precautionary measures concerning their material.

A. Burn Prevention

Wear protective clothing - gauntlet gloves designed for use in welding, hat, and high safety-toe shoes. Button shirt collar and pocket flaps, and wear cuffless trousers to avoid entry of sparks and slag.

Wear helmet with safety goggles or glasses with side shields underneath, appropriate filter lenses or plates (protected by clear cover glass). This is a **MUST** for

welding or cutting, (and chipping) to protect the eyes from radiant energy and flying metal. Replace cover glass when broken, pitted, or spattered. See 1-3A.2.

Avoid oily or greasy clothing. A spark may ignite them.

Hot metal such as electrode stubs and workpieces should never be handled without gloves.

Medical first aid and eye treatment. First aid facilities and a qualified first aid person should be available for each shift unless medical facilities are close by for immediate treatment of flash burns of the eyes and skin burns.

Ear plugs should be worn when working on overhead or in a confined space. A hard hat should be worn when others work overhead.

Flammable hair preparations should not be used by persons intending to weld or cut.

B. Toxic Fume Prevention

Severe discomfort, illness or death can result from fumes, vapors, heat, or oxygen enrichment or depletion that welding (or cutting) may produce. Prevent them with adequate ventilation as described in ANSI Standard Z49.1 listed 1 in Standards index. **NEVER** ventilate with oxygen.

Lead -, cadmium -, zinc -, mercury -, and beryllium - bearing and similar materials, when welded (or cut) may produce harmful concentrations of toxic fumes. Adequate local exhaust ventilation must be used, or each person in the area as well as the operator must wear an air-supplied respirator. For beryllium, both must be used.

Metals coated with or containing materials that emit toxic fumes should not be heated unless coating is removed from the work surface, the area is well ventilated, or the operator wears an air-supplied respirator.

Work in a confined space only while it is being ventilated and, if necessary, while wearing an air-supplied respirator.

Gas leaks in a confined space should be avoided. Leaked gas in large quantities can change oxygen concentration dangerously. Do not bring gas cylinders into a confined space.

Leaving confined space, shut OFF gas supply at source to prevent possible accumulation of gases in the space if downstream valves have been accidentally opened or left open. Check to be sure that the space is safe before re-entering it.

Vapors from chlorinated solvents can be decomposed by the heat of the arc (or flame) to form PHOSGENE, a

highly toxic gas, and other lung and eye irritating products. The ultraviolet (radiant) energy of the arc can also decompose trichloroethylene and perchloroethylene vapors to form phosgene. DO NOT WELD or cut where solvent vapors can be drawn into the welding or cutting atmosphere or where the radiant energy can penetrate to atmospheres containing even minute amounts of trichloroethylene or perchloroethylene.

C. Fire and Explosion Prevention

Causes of fire and explosion are: combustibles reached by the arc, flame, flying sparks, hot slag or heated material; misuse of compressed gases and cylinders; and short circuits.

BE AWARE THAT flying sparks or falling slag can pass through cracks, along pipes, through windows or doors, and through wall or floor openings, out of sight of the goggled operator. Sparks and slag can fly 35 feet.

To prevent fires and explosion:

Keep equipment clean and operable, free of oil, grease, and (in electrical parts) of metallic particles that can cause short circuits.

If combustibles are in area, do NOT weld or cut. Move the work if practicable, to an area free of combustibles. Avoid paint spray rooms, dip tanks, storage areas, ventilators. If the work cannot be moved, move combustibles at least 35 feet away out of reach of sparks and heat; or protect against ignition with suitable and snug-fitting, fire-resistant covers or shields.

Walls touching combustibles on opposite sides should not be welded on (or cut). Walls, ceilings, and floor near work should be protected by heat-resistant covers or shields.

Fire watcher must be standing by with suitable fire extinguishing equipment during and for some time after welding or cutting if:

- a. appreciable combustibles (including building construction) are within 35 feet
- b. appreciable combustibles are further than 35 feet but can be ignited by sparks
- c. openings (concealed or visible) in floors or walls within 35 feet may expose combustibles to sparks
- d. combustibles adjacent to walls, ceilings, roofs, or metal partitions can be ignited by radiant or conducted heat.

Hot work permit should be obtained before operation to ensure supervisor's approval that adequate precautions have been taken.

After work is done, check that area is free of sparks, glowing embers, and flames.

An empty container that held combustibles, or that can produce flammable or toxic vapors when heated, must

never be welded on or cut, unless container has first been cleaned as described in AWS Standard A6.0, listed 7 in Standards index.

This includes: a thorough steam or caustic cleaning (or a solvent or water washing, depending on the combustible's solubility) followed by purging and inerting with nitrogen or carbon dioxide, and using protective equipment as recommended in A6.0. Waterfilling just below working level may substitute for inerting.

A container with unknown contents should be cleaned (see paragraph above). Do NOT depend on sense of smell or sight to determine if it is safe to weld or cut.

Hollow castings or containers must be vented before welding or cutting. They can explode.

Explosive atmospheres. Never weld or cut where the air may contain flammable dust, gas, or liquid vapors (such as gasoline).

D. Compressed Gas Equipment

Standard precautions. Comply with precautions in this manual, and those detailed in CGA Standard P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, listed 11 in Standards index.

1. Pressure Regulators

Regulator relief valve is designed to protect only the regulator from overpressure; it is not intended to protect any downstream equipment. Provide such protection with one or more relief devices.

Never connect a regulator to a cylinder containing gas other than that for which the regulator was designed.

Remove faulty regulator from service immediately for repair (first close cylinder valve). The following symptoms indicate a faulty regulator:

Leaks - if gas leaks externally.

Excessive Creep - if delivery pressure continues to rise with downstream valve closed.

Faulty Gauge - if gauge pointer does not move off stop pin when pressurized, nor returns to stop pin after pressure release.

Repair. Do NOT attempt repair. Send faulty regulators for repair to manufacturer's designated repair center, where special techniques and tools are used by trained personnel.

2. Cylinders

Cylinders must be handled carefully to prevent leaks and damage to their walls, valves, or safety devices:

Avoid electrical circuit contact with cylinders including third rails, electrical wires, or welding circuits. They can produce short circuit arcs that may lead to a serious accident. (See 1-3C.)

ICC or DOT marking must be on each cylinder. It is an assurance of safety when the cylinder is properly handled.

Identifying gas content. Use only cylinders with name of gas marked on them; do not rely on color to identify gas content. Notify supplier if unmarked. NEVER DEFACE or alter name, number, or other markings on a cylinder. It is illegal and hazardous.

Empties: Keep valves closed, replace caps securely; mark MT; keep them separate from FULLS and return promptly.

Prohibited use. Never use a cylinder or its contents for other than its intended use, NEVER as a support or roller.

Locate or secure cylinders so they cannot be knocked over.

Passageways and work areas. Keep cylinders clear of areas where they may be struck.

Transporting cylinders. With a crane, use a secure support such as a platform or cradle. Do NOT lift cylinders off the ground by their valves or caps, or by chains, slings, or magnets.

Do NOT expose cylinders to excessive heat, sparks, slag, and flame, etc. that may cause rupture. Do not allow contents to exceed 130°F. Cool with water spray where such exposure exists.

Protect cylinders particularly valves from bumps, falls, falling objects, and weather. Replace caps securely when moving cylinders.

Stuck valve. Do NOT use a hammer or wrench to open a cylinder valve that can not be opened by hand. Notify your supplier.

Mixing gases. Never try to mix any gases in a cylinder.

Never refill any cylinder.

Cylinder fittings should never be modified or exchanged.

3. Hose

Prohibited use. Never use hose other than that designed for the specified gas. A general hose identification rule is: red for fuel gas, green for oxygen, and black for inert gases.

Use ferrules or clamps designed for the hose (not ordinary wire or other substitute) as a binding to connect hoses to fittings.

No copper tubing splices. Use only standard brass fittings to splice hose.

Avoid long runs to prevent kinks and abuse. Suspend hose off ground to keep it from being run over, stepped on, or otherwise damaged.

Coil excess hose to prevent kinks and tangles.

Protect hose from damage by sharp edges, and by sparks, slag, and open flame.

Examine hose regularly for leaks, wear, and loose connections. Immerse pressured hose in water; bubbles indicate leaks.

Repair leaky or worn hose by cutting area out and splicing (1-2D3). Do NOT use tape.

4. Proper Connections

Clean cylinder valve outlet of impurities that may clog orifices and damage seats before connecting regulator. Except for hydrogen, crack valve momentarily, pointing outlet away from people and sources of ignition. Wipe with a clean lintless cloth.

Match regulator to cylinder. Before connecting, check that the regulator label and cylinder marking agree, and that the regulator inlet and cylinder outlet match. NEVER CONNECT a regulator designed for a particular gas or gases to a cylinder containing any other gas.

Tighten connections. When assembling threaded connections, clean and smooth seats where necessary. Tighten. If connection leaks, disassemble, clean, and retighten using properly fitting wrench.

Adapters. Use a CGA adapter (available from your supplier) between cylinder and regulator, if one is required. Use two wrenches to tighten adapter marked RIGHT and LEFT HAND threads.

Regulator outlet (or hose) connections may be identified by right hand threads for oxygen and left hand threads (with grooved hex on nut or shank) for fuel gas.

5. Pressurizing Steps:

Drain regulator of residual gas through suitable vent before opening cylinder (or manifold valve) by turning adjusting screw in (clockwise). Draining prevents excessive compression heat at high pressure seat by allowing seat to open on pressurization. Leave adjusting screw engaged slightly on single-stage regulators.

Stand to side of regulator while opening cylinder valve.

Open cylinder valve slowly so that regulator pressure increases slowly. When gauge is pressurized (gauge reaches regulator maximum) leave cylinder valve in following position: For oxygen, and inert gases, open fully to seal stem against possible leak. For fuel gas, open to less than one turn to permit quick emergency shutoff.

Use pressure charts (available from your supplier) for safe and efficient, recommended pressure settings on regulators.

Check for leaks on first pressurization and regularly there-after. Brush with soap solution (capful of Ivory

Liquid* or equivalent per gallon of water). Bubbles indicate leak. Clean off soapy water after test; dried soap is combustible.

E. User Responsibilities

Remove leaky or defective equipment from service immediately for repair. See User Responsibility statement in equipment manual.

F. Leaving Equipment Unattended

Close gas supply at source and drain gas.

G. Rope Staging-Support

Rope staging-support should not be used for welding or cutting operation; rope may burn.

1-3. ARC WELDING - Comply with precautions in 1-1, 1-2, and this section. Arc Welding, properly done, is a safe process, but a careless operator invites trouble. The equipment carries high currents at significant voltages. The arc is very bright and hot. Sparks fly, fumes rise, ultraviolet and infrared energy radiates, weldments are hot, and compressed gases may be used. The wise operator avoids unnecessary risks and protects himself and others from accidents. Precautions are described here and in standards referenced in index.

A. Burn Protection

Comply with precautions in 1-2.

The welding arc is intense and visibly bright. Its radiation can damage eyes, penetrate lightweight clothing, reflect from light-colored surfaces, and burn the skin and eyes. Skin burns resemble acute sunburn, those from gas-shielded arcs are more severe and painful. **DON'T GET BURNED; COMPLY WITH PRECAUTIONS.**

1. Protective Clothing

Wear long-sleeve clothing (particularly for gas-shielded arc) in addition to gloves, hat, and shoes (1-2A). As necessary, use additional protective clothing such as leather jacket or sleeves, flame-proof apron, and fire-resistant leggings. Avoid outer garments of untreated cotton.

Bare skin protection. Wear dark, substantial clothing. Button collar to protect chest and neck and button pockets to prevent entry of sparks.

2. Eye and Head Protection

Protect eyes from exposure to arc. **NEVER** look at an electric arc without protection.

Welding helmet or shield containing a filter plate shade no. 12 or denser must be used when welding. Place over face before striking arc.

*Trademark of Proctor & Gamble.

Protect filter plate with a clear cover plate.

Cracked or broken helmet or shield should **NOT** be worn; radiation can pass through to cause burns.

Cracked, broken, or loose filter plates must be replaced **IMMEDIATELY**. Replace clear cover plate when broken, pitted, or spattered.

Flash goggles with side shields **MUST** be worn under the helmet to give some protection to the eyes should the helmet not be lowered over the face before an arc is struck. Looking at an arc momentarily with unprotected eyes (particularly a high intensity gas-shielded arc) can cause a retinal burn that may leave a permanent dark area in the field of vision.

3. Protection of Nearby Personnel

Enclosed welding area. For production welding, a separate room or enclosed bay is best. In open areas, surround the operation with low-reflective, non-combustible screens or panels. Allow for free air circulation, particularly at floor level.

Viewing the weld. Provide face shields for all persons who will be looking directly at the weld.

Others working in area. See that all persons are wearing flash goggles.

Before starting to weld, make sure that screen flaps or bay doors are closed.

B. Toxic Fume Prevention

Comply with precautions in 1-2B.

Generator engine exhaust must be vented to the outside air. Carbon monoxide can kill.

C. Fire and Explosion Prevention

Comply with precautions in 1-2C.

Equipment's rated capacity. Do not overload arc welding equipment. It may overheat cables and cause a fire.

Loose cable connections may overheat or flash and cause a fire.

Never strike an arc on a cylinder or other pressure vessel. It creates a brittle area that can cause a violent rupture or lead to such a rupture later under rough handling.

D. Compressed Gas Equipment

Comply with precautions in 1-2D.

E. Shock Prevention

Exposed hot conductors or other bare metal in the welding circuit, or in ungrounded, electrically-HOT equipment can fatally shock a person whose body becomes a conductor. **DO NOT STAND, SIT, LIE, LEAN ON, OR TOUCH** a wet surface when welding, without suitable protection.

To protect against shock:

Keep body and clothing dry. Never work in damp area without adequate insulation against electrical shock. Stay on a dry duckboard, or rubber mat when dampness or sweat can not be avoided. Sweat, sea water, or moisture between body and an electrically HOT part - or grounded metal - reduces the body surface electrical resistance, enabling dangerous and possibly lethal currents to flow through the body.

1. Grounding the Equipment

When arc welding equipment is grounded according to the National Electrical Code, and the work is grounded according to ANSI Z49.1 "Safety In Welding And Cutting," a voltage may exist between the electrode and any conducting object. Examples of conducting objects include, but are not limited to, buildings, electrical tools, work benches, welding power source cases, workpieces, etc. **Never touch the electrode and any metal object unless the welding power source is off.**

When installing, connect the frames of each unit such as welding power source, control, work table, and water circulator to the building ground. Conductors must be adequate to carry ground currents safely. Equipment made electrically HOT by stray current may shock, possibly fatally. **Do NOT GROUND** to electrical conduit, or to a pipe carrying ANY gas or a flammable liquid such as oil or fuel.

Three-phase connection. Check phase requirements of equipment before installing. If only 3-phase power is available, connect single-phase equipment to only two wires of the 3-phase line. **Do NOT** connect the equipment ground lead to the third (live) wire, or the equipment will become electrically HOT - a dangerous condition that can shock, possibly fatally.

Before welding, check ground for continuity. Be sure conductors are touching bare metal of equipment frames at connections.

If a line cord with a ground lead is provided with the equipment for connection to a switchbox, connect the ground lead to the grounded switchbox. If a three-prong plug is added for connection to a grounded mating receptacle, the ground lead must be connected to the ground prong only. If the line cord comes with a three-prong plug, connect to a grounded mating receptacle. **Never** remove the ground prong from a plug, or use a plug with a broken off ground prong.

2. Electrode Holders

Fully insulated electrode holders should be used. **Do NOT** use holders with protruding screws.

3. Connectors

Fully insulated lock-type connectors should be used to join welding cable lengths.

4. Cables

Frequently inspect cables for wear, cracks and damage. **IMMEDIATELY REPLACE** those with excessively worn or damaged insulation to avoid possibly - lethal shock from bared cable. Cables with damaged areas may be taped to give resistance equivalent to original cable.

Keep cable dry, free of oil and grease, and protected from hot metal and sparks.

5. Terminals And Other Exposed Parts

Terminals and other exposed parts of electrical units should have insulating covers secured before operation.

6. Electrode

a. Equipment with output on/off control (contactor)

Welding power sources for use with the gas metal arc welding (GMAW), gas tungsten arc welding (GTAW) and similar processes normally are equipped with devices that permit on-off control of the welding power output. When so equipped the electrode wire becomes electrically HOT when the power source switch is ON and the welding gun switch is closed. **Never** touch the electrode wire or any conducting object in contact with the electrode circuit unless the welding power source is off.

b. Equipment without output on/off control (no contactor)

Welding power sources used with shielded metal arc welding (SMAW) and similar processes may not be equipped with welding power output on-off control devices. With such equipment the electrode is electrically HOT when the power switch is turned ON. **Never** touch the electrode unless the welding power source is off.

7. Safety Devices

Safety devices such as interlocks and circuit breakers should not be disconnected or shunted out.

Before installation, inspection, or service, of equipment, shut OFF all power and remove line fuses (or lock

or red-tag switches) to prevent accidental turning ON of power. Disconnect all cables from welding power source, and pull all 115 volts line-cord plugs.

Do not open power circuit or change polarity while welding. If, in an emergency, it must be disconnected, guard against shock burns, or flash from switch arcing.

Leaving equipment unattended. Always shut OFF and disconnect all power to equipment.

Power disconnect switch must be available near the welding power source.

F. Protection For Wearers Of Electronic Life Support Devices (Pacemakers)

Magnetic fields from high currents can affect pacemaker operation. Persons wearing electronic life support equipment (pacemaker) should consult with their doctor before going near arc welding, gouging, or spot welding operations.

1-4. STANDARDS BOOKLET INDEX

For more information, refer to the following standards or their latest revisions and comply as applicable:

1. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING obtainable from the American Welding Society, 550 Le Jeune Rd, P.O. Box 351040, Miami, FL 33135.
2. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
3. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the U.S. Government Printing Office, Washington, D.C. 20402.
4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY-TOE FOOTWEAR obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.
6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.
7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES obtainable from the American Welding Society, 550 Le Jeune Rd. P.O. Box 351040, Miami FL 33135.
8. NFPA Standard 51, OXYGEN - FUEL GAS SYSTEMS FOR WELDING AND CUTTING obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.
9. NFPA Standard 70-1978, NATIONAL ELECTRICAL CODE obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.
10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.
11. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS obtainable from the Compressed Gas Association, 500 Fifth Avenue, New York, NY 10036.
12. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.
13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103.
14. American Welding Society Standard AWSF4.1 "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", obtainable from the American Welding Society, 550 Le Jeune Rd. P.O. Box 351040, Miami, FL 33135.
15. ANSI Standard Z88.2 "Practice for Respiratory Protection" obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

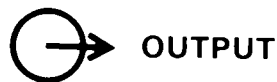
SECTION 2 - INTRODUCTION

Rated Weld Output At 60% Duty Cycle	Max. Open-Circuit Volts	Input At Rated Load Output 60 Hz Single-Phase					kw	Control Circuit Voltage At Gun	Electrode Wire Feed Speed	Electrode Wire Diameter Capability	Overall Dimensions	Weight	
		Amperes At				kva						Net	Ship
		200V	230V	460V	575V								
150 Amperes @ 23 Volts	32	26.5	24	12	9.6	5.5	4.8	24 Volts DC	60-486 ipm (1.5 - 12.3 mpm)	.023/.025, .030, & .035 in. (0.6, 0.8, & 0.9 mm)	Height: 30 in. (762 mm) Width: 13-1/2 in. (343 mm) Depth: 27 in. (686 mm)	205 lbs. (93 kg)	215 lbs. (98 kg)

Add 5 lbs. (2.3 kg) for units with optional spot panel.

Figure 2 - 1. Specifications

2 - 1. VOLT-AMPERE CURVES (Figure 2-2)



The volt-ampere curves show the available output of the welding power source in each of the output receptacle taps with the FINE TUNING/WIRE SPEED control at the maximum position. Different settings on the FINE TUNING/WIRE SPEED control provide different volt-ampere curves.

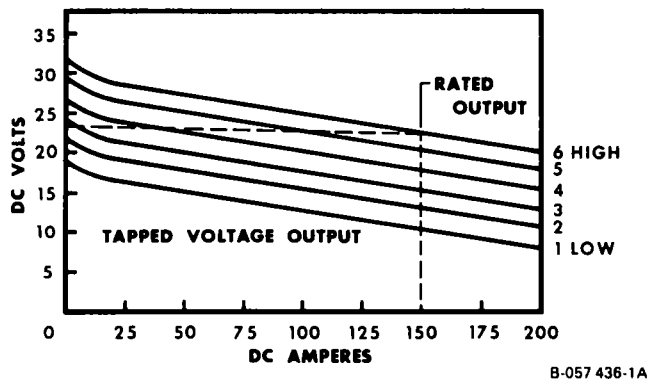


Figure 2 - 2. Volt-Ampere Curves

2 - 2. DUTY CYCLE (Figure 2-3) - The duty cycle of a welding power source is the percentage of a ten minute period that a welding power source can be operated at a given output without causing overheating and damage to the unit. This welding power source is rated at 60 percent duty cycle. This means that the welding power source can be operated at rated load for six minutes out of every ten. During the remaining four minutes, the unit should idle to permit proper cooling. If the welding amperes are increased the duty cycle will decrease. Figure 2-3 enables the operator to determine the output of the welding power source at various duty cycles.

CAUTION: EXCEEDING DUTY CYCLE RATINGS will damage the welding power source.

- Do not exceed indicated duty cycles.

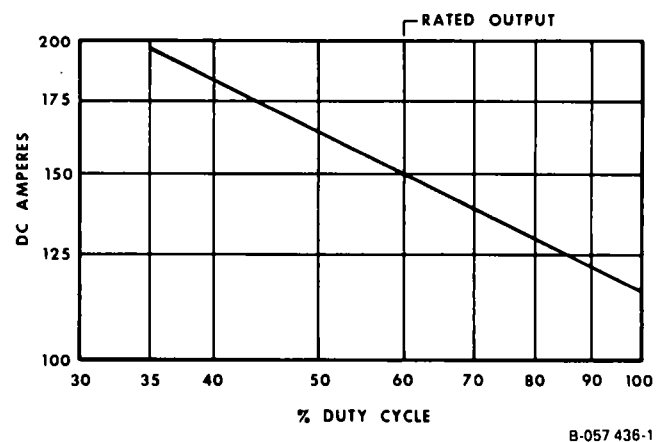


Figure 2 - 3. Duty Cycle Chart

2 - 3. GENERAL INFORMATION AND SAFETY

A. General

Information presented in this manual and on various labels, tags, and plates on this unit pertains to equipment design, installation, operation, maintenance, and troubleshooting which should be read, understood, and followed for the safe and effective use of this equipment.

The nameplate of this unit uses international symbols for labeling the front panel controls. The symbols also appear at the appropriate section in the text.

B. Safety

The installation, operation, maintenance, and troubleshooting of arc welding equipment requires practices and procedures which ensure personal safety and the safety of others. Therefore, this equipment is to be installed, operated, and maintained only by qualified persons in accordance with this manual and all applicable codes such as, but not limited to, those listed at the end of Section 1 - Safety Rules For Operation Of Arc Welding Power Source.

Safety instructions specifically pertaining to this unit appear throughout this manual highlighted by the signal words **WARNING** and **CAUTION** which identify different levels of hazard.

WARNING statements include installation, operation, and maintenance procedures or practices which if not carefully followed could result in serious personal injury or loss of life.

CAUTION statements include installation, operation, and maintenance procedures or practices which if not carefully followed could result in minor personal injury or damage to this equipment.

A third signal word, **IMPORTANT**, highlights instructions which need special emphasis to obtain the most efficient operation of this equipment.

2 - 4. RECEIVING-HANDLING - Before installing this equipment, clean all packing material from around the unit, and carefully inspect for any damage that may have occurred during shipment. Any claims for loss or damage that may have occurred in transit must be filed **by the purchaser with the carrier**. A copy of the bill of lading will be furnished by the manufacturer on request if occasion to file claim arises.

When requesting information concerning this equipment, it is essential that Model Description and Serial Number of the equipment be supplied.

2 - 5. DESCRIPTION

This unit is a single-phase constant voltage dc arc welding power source and wire feeder system designed for Gas Metal Arc Welding (GMAW). It is designed primarily for use as a dc Electrode Positive/Reverse Polarity machine. Rated weld output is 150 amperes, 23 volts dc, at 60% duty cycle.

Models with the optional SPOT PULSE WELD PANEL provide the controls for regulating spot weld time/pulse on time, burnback time, and pulse off time.

2 - 6. SUPPLIED EQUIPMENT (Figure 2-4)

The following equipment is supplied with the welding power source and requires customer installation or assembly:

- A. Running gear with gas cylinder rack and bracket.
- B. Wall receptacle (200/230 volt models only).
- C. Work cable, work clamp, and jack plug.
- D. MWG-200 gun with 5/8 inch (16 mm) nozzle and two contact tubes for each wire size.
- E. Drive rolls for .023/.025, .030, and .035 in. (0.6, 0.8, and 0.9 mm) hard wire.
- F. Optional SPW-1 Spot Panel and three nozzles.

The welding power source is factory equipped with a 9 ft. (2.7 m) power cord and gas valve.

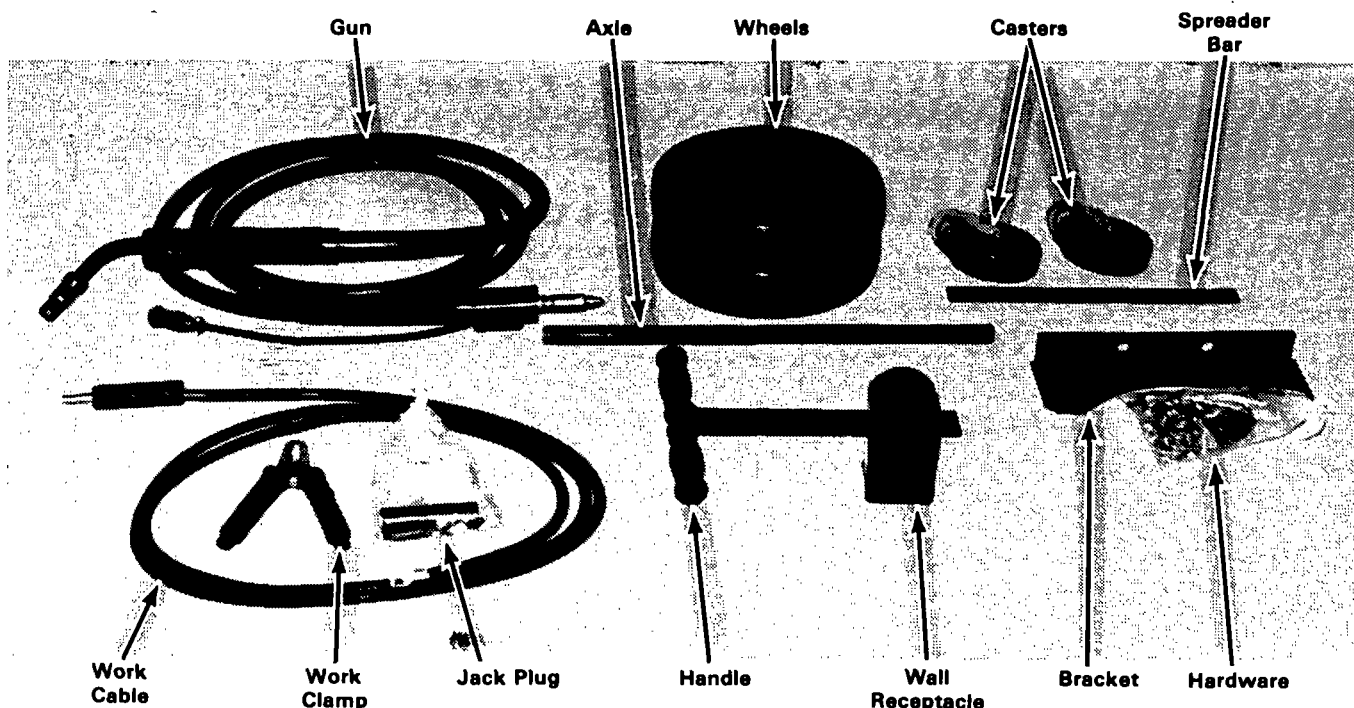


Figure 2-4. Supplied Parts

2 - 7. ADDITIONAL REQUIRED EQUIPMENT (Figure 2-5)

IMPORTANT: Contact your supplier or see the yellow pages of the local telephone book for the location of the nearest Auto Arc Distributor.

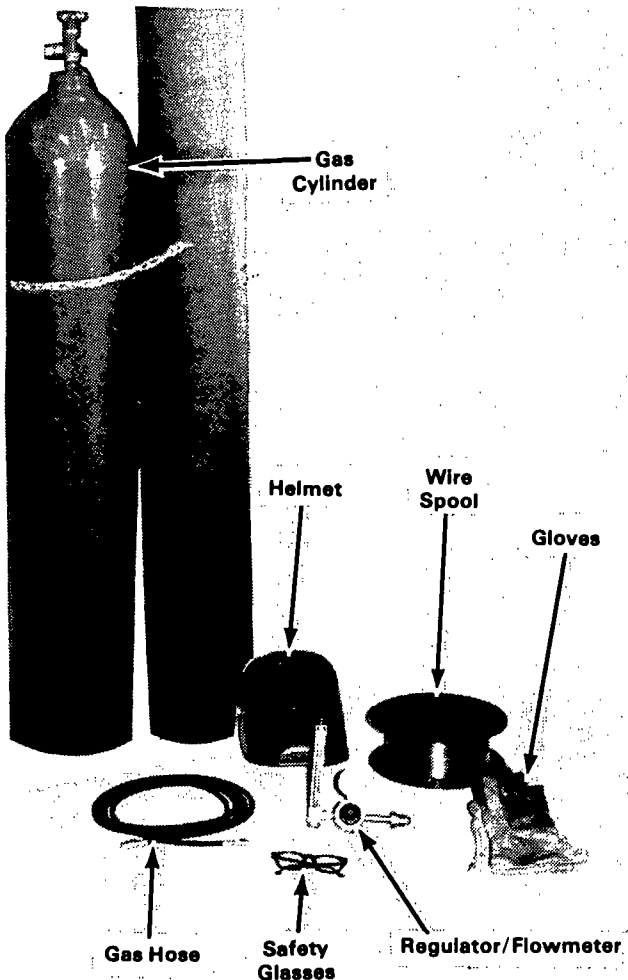


Figure 2-5. Additional Supplies Required

A. Gas Cylinder

Two types of gas mixtures are generally used with Gas Metal Arc Welding (GMAW) of thin gauge sheet steel. Carbon dioxide (CO₂) is the gas recommended for use with this welding power source/gun combination. A mixture of 75 percent argon and 25 percent carbon dioxide also gives favorable results. Obtain a cylinder of selected shielding gas from your supplier.

B. Regulator/Flowmeter

Regulator/flowmeters provide a constant shielding gas pressure and flow rate during the welding process. Because gases have different properties, each regulator/flowmeter is designed to be used with a specific gas or mixture of gases. Regulator/flowmeters

cannot be changed from one gas to another unless the proper adapters are installed. Obtain the proper regulator/flowmeter for the type of gas used.

C. Gas Hose

Measure distance from gas cylinder to welding power source. Obtain good quality 5/8 in. (16 mm) O.D. S.A.E. gas hose, and install 5/8-18 right hand thread fittings on both ends of hose.

D. Spool Of Wire

Selection of the correct welding wire is important in Gas Metal Arc Welding (GMAW). There are many types to choose from, but certain wires are best suited for welding thin gauge sheet steel. The American Welding Society (AWS) classification for GMAW wires is usually indicated on the label of the wire spool. Two AWS wire classes recommended are E70S-6 and E70S-3. The E70S-6 provides a more fluid (wetter) weld puddle and a flatter bead; however, E70S-3 is acceptable for use with this welding power source. Obtain a spool of selected wire.

E. Personal Safety Equipment

When using this welding power source, wear a welding helmet, fitted with the proper filter lens, to protect the eyes from the welding arc. Also important is wearing protective clothing, safety glasses, and gloves to prevent injury.

F. Offset/Punching Tool (Figure 2-6)

The welding process in the repair of automotive sheet steel can be made easier with the use of a special Offset/Punching Tool. This tool has a dual purpose, rotating head. The damaged area is cut away and the jaws of the offset portion of the head are placed over the sheet steel. When pressure is applied to the handles, the tool will indent a small offset in the sheet steel. A new piece of sheet steel is then cut to size and placed in position to overlap the offset portion. The new piece of sheet steel is then welded into place, sanded, filled with body putty and finished sanded. The head of the tool can be rotated one-half turn to be used as a punching tool. The punching tool will expedite riveting operations. The use of this tool will help keep material use and finishing time to a minimum.

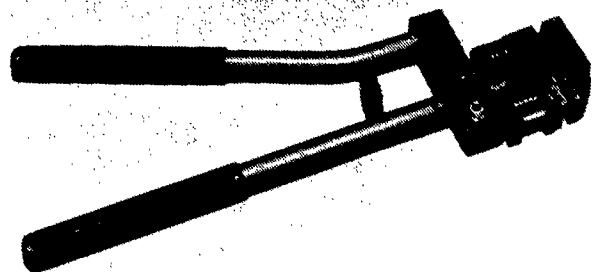


Figure 2-6. Offset/Punching Tool

2 - 8. OPTIONAL EQUIPMENT

The following equipment can be obtained to extend the capabilities of the basic unit or to suit special applications:

- A. SPW-1, Spot, Pulse, Continuous Panel (includes three spot nozzles) (for installation see Section 3-3)
- B. Gun cable holder
- C. 25 Ft. (7.6 m) power cord extension

2 - 9. CONSUMABLE PARTS

The following parts are subject to wear or damage in normal use:

- A. Contact tubes
- B. Nozzles
- C. Gun liner
- D. Drive rolls

SECTION 3 - INSTALLATION

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Disconnect input power conductors from deenergized supply line **BEFORE** moving unit.

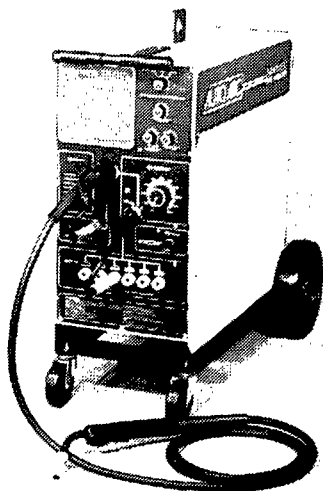


Figure 3 - 1. Completely Assembled Unit

3 - 1. LOCATION (Figure 3-2)

WARNING: FALLING EQUIPMENT can cause serious personal injury and equipment damage.

- Use lifting eye to lift unit only, **NOT** running gear, gas cylinders, or any other heavy accessories.
- Use equipment of adequate capacity to lift the unit.
- If using lift forks to handle this unit, be sure the lift forks are long enough to extend out of the opposite side of the base.

Using lift forks too short will expose internal components to damage should the tips of the lift forks penetrate the bottom of the unit.

RESTRICTED AIR FLOW causes overheating and possible damage to internal parts.

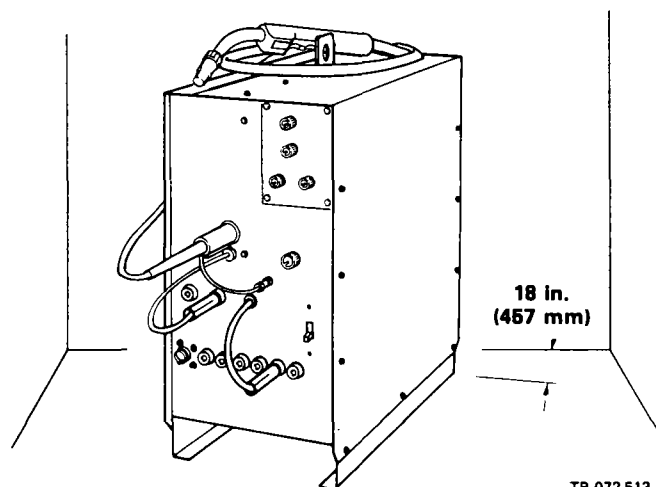
- Maintain at least 18 inches (457 mm) of unrestricted space on all sides of unit, and keep underside free of obstructions.
- Do not place any filtering device over the intake air passages of this welding power source.

Warranty is void if any type of filtering device is used.

If the welding power source is not installed on a running gear, a lifting eye is provided for moving the unit, and holes are provided in base for mounting purposes.

The location should allow room to remove the top cover and side panels for installation, maintenance, and repair procedures.

The service life and efficiency of this unit are reduced when the unit is subjected to high levels of dust, dirt, moisture, corrosive vapors, and extreme heat.



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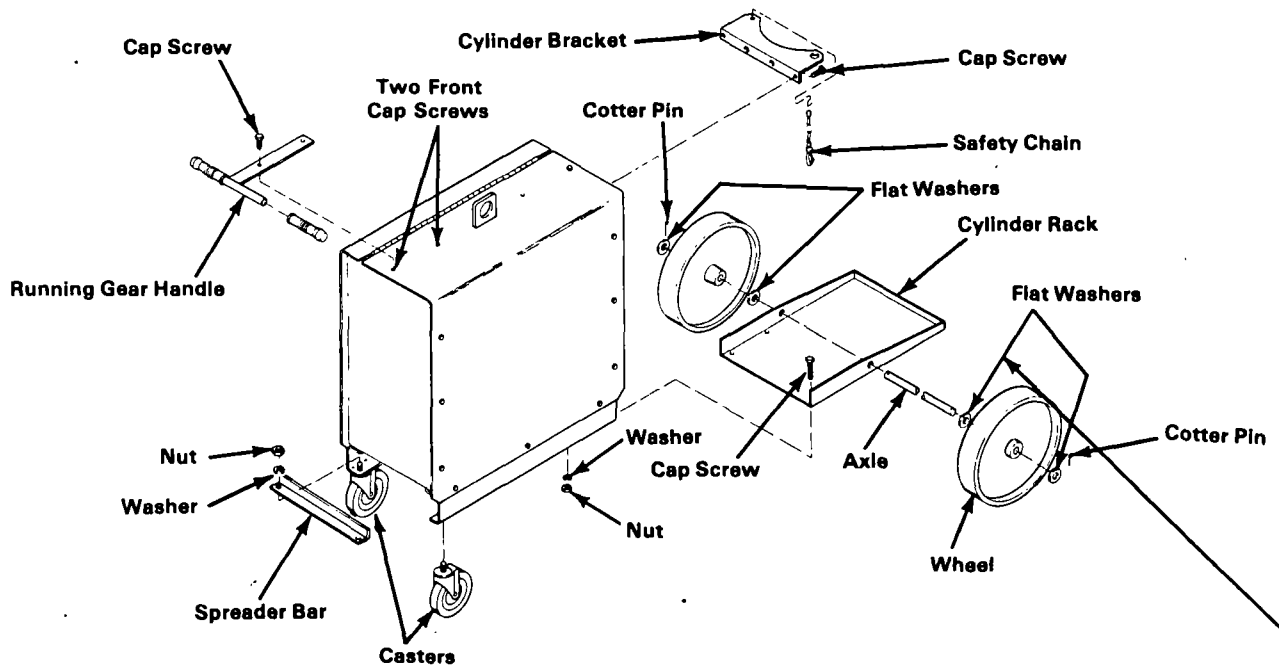
Figure 3 - 2. Location

3 - 2. RUNNING GEAR INSTALLATION (Figure 3-3)

CAUTION: UNCONTROLLED TILTING OR TIPPING of unit can result in personal injury or equipment damage.

- Use equipment of adequate capacity to lift the unit.
- If using lift forks to handle this unit, be sure the lift forks are long enough to extend out of the opposite side of the base.
- Do not place any part of the body under the unit while it is suspended.

Place blocks under frame of unit before attaching running gear.



TC-049 808-C

Figure 3 - 3. Running Gear Installation

1. Install the two 4 in. (102 mm) swivel casters and spreader bar on the front corners of the welding power source base as shown in Figure 3-3 using 3/8 in. hardware.
2. Block the unit up securely in middle to ease installation of rear wheel/gas cylinder rack assembly.
3. Slide axle through cylinder rack, and install a wheel onto each end of axle with a 3/4 in. flat washer on each side of wheel.
4. Secure wheels in place with cotter pins by bending both legs of cotter pin around the axle in one direction or by bending one leg clockwise and the other leg counterclockwise (legs should conform to contour of axle as tightly as possible).
5. Install cylinder rack on welding power source base using 5/16-18 x 3/4 cap screws and associated hardware (see Figure 3-3).
6. Remove the two front cap screws in top of welding power source wrapper and discard. Install running gear handle to wrapper using 1/4-20 x 3/4 cap screws as shown in Figure 3-3.
7. Install cylinder bracket to rear panel of welding power source as shown in Figure 3-3 using 1/4-20 x 3/4 cap screws and existing holes in rear panel.
8. Set gas cylinder in rack, and lock in position with safety chain. Cylinder must be secured at all times.

3 - 3. OPTIONAL SPW-1 PANEL INSTALLATION (Figure 3-4)

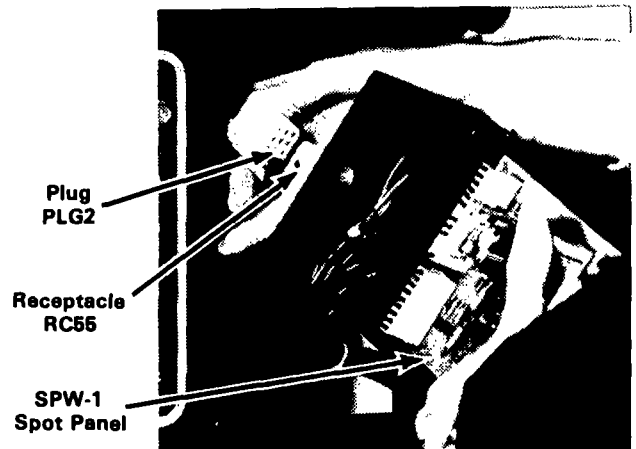


Figure 3 - 4. SPW-1 Panel Installation

WARNING: ELECTRIC SHOCK can kill.

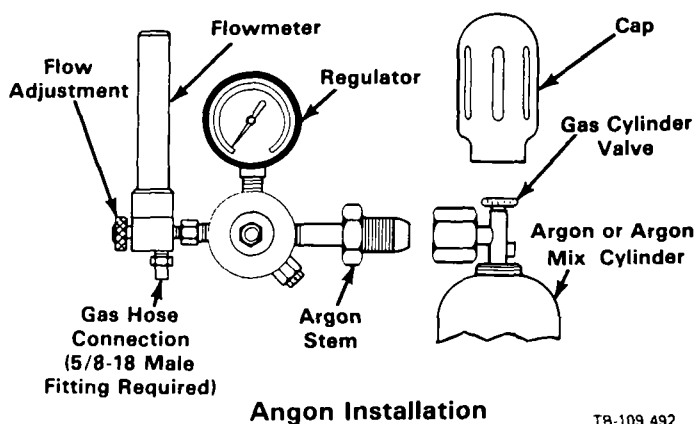
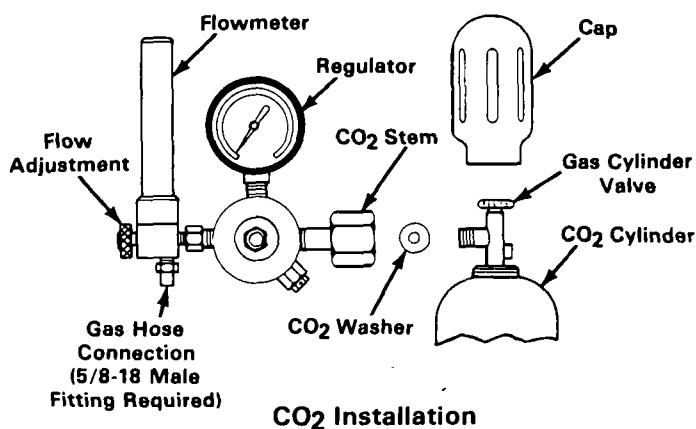
- Do not touch live electrical parts.
- Shut down welding power source and disconnect input power employing "lockout/tagging procedures" before inspecting or installing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

IMPORTANT: Retain all hardware removed during this procedure for reinstallation. All directions, such as left or right, are with respect to the operator facing the front panel.

1. Remove module cover plate from upper right corner of front panel.
2. Locate wiring harness clamped to air baffle inside unit. Remove wiring harness from first clamp, and carefully pull end of wiring harness with connectors through opening in front panel—the harness will come through approximately 2 in. (51 mm).
3. Disconnect jumpered connector from plug PLG2.
4. Connect receptacle RC55 from SPW-1 panel to PLG2. Be sure the connectors are locked together (see Figure 3-4).
5. Install SPW-1 panel into upper right corner of front panel, and secure using screws removed in Step 1.

3 - 4. SHIELDING GAS INSTALLATION



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Figure 3 - 5. Typical Regulator/Flowmeter

A. Gas Cylinder (Customer Supplied) (Figure 2-5)

Secure the gas cylinder to the running gear with supplied chain. If the running gear is not to be used, chain cylinder to a wall or other stationary support to prevent the cylinder from falling over and breaking off the valve.

WARNING: PRESSURIZED CYLINDERS can rupture causing serious personal injury and loss of life; **FALLING CYLINDERS** can cause serious injury and equipment damage.

- Keep cylinders away from any welding or other electrical circuits.
- Never allow a welding electrode to touch any cylinder.
- Always fasten cylinder securely to running gear bracket, a wall, or other stationary support.

B. Regulator/Flowmeter (Customer Supplied) (Figure 3-5)

1. With the cylinder correctly installed, remove cylinder cap. Stand to one side of the cylinder valve, and open the valve slightly. When gas flows from cylinder, close valve. This procedure gets rid of any dust that may have accumulated around the valve seat.
2. Regulator/flowmeter must be properly equipped with a stem, nut connectors and gasket for use with either CO₂ cylinders or Argon/CO₂ cylinders.

IMPORTANT: A gasket should be installed to prevent leaks. Do not use lubricants or sealing agents.

3. Install gas regulator onto gas cylinder valve; keep the face of the regulator/flowmeter gauge in a vertical position, and tighten stem nut securely onto gas cylinder.
4. A shielding gas output fitting is provided at the rear of the welding power source for making gas connections. Attach one end of the gas hose to this output fitting. Attach other end of the gas hose to the regulator/flowmeter.

3 - 5. WORK CABLE ASSEMBLY

A 10 foot (3 m) work cable with a lug attached to one end is supplied with the unit. To install work clamp and jack plug onto cable, proceed as follows:

A. Work Clamp Installation (Figure 3-6)

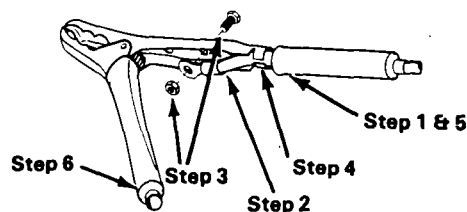


Figure 3 - 6. Work Clamp Installation

1. Insert the end of the work clamp with the terminal lug on it through one of the two supplied insulating sleeves.
2. Lay the work cable inside the handle of the work clamp which has the flattest inner surface.

- Align the smaller hole in the work clamp handle with the hole in the work cable terminal lug. Secure the terminal lug to the work clamp with the supplied nut and bolt.
- Bend the tabs on the end of the work clamp handle around the work cable.
- Slide the insulating sleeve on the work cable over the work clamp handle.
- Slide the remaining insulating sleeve over the other work clamp handle.

B. Jack Plug Installation (Figure 3-7)

The jack plug, included in the parts package, must be installed onto the remaining end of the work cable as follows:

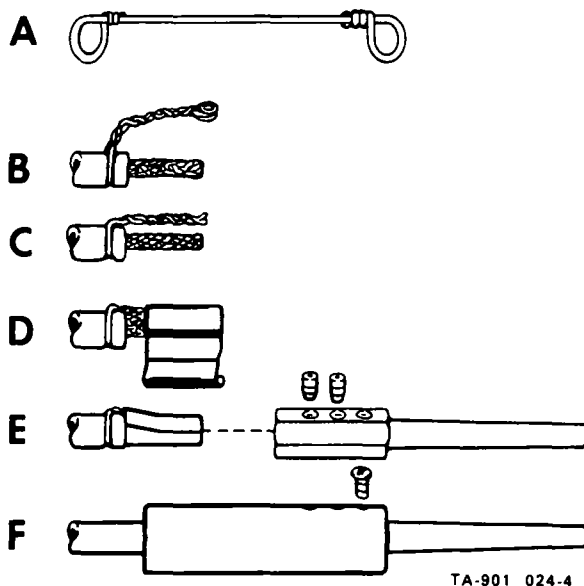


Figure 3 - 7. Jack Plug Installation

- Remove 1 in. (25.4 mm) of insulation from end of cable.
- Clamp cable in a vise with uninsulated end extending upward out of vise approximately 1-3/4 in. (44.5 mm).
- Place steel tie wire (item A) approximately 1/4 in. (6.4 mm) from end of insulation.
- Make half turn around cable bringing looped ends of tie wire together.
- Insert a 3/8 in. (9.5 mm) diameter rod through looped ends of tie wire.

- Twist tie wire (B) until entire tie wire is twisted and is tight around insulation of cable.
- Cut off looped ends of tie wire.
- Bend the twisted tie wire over and along the side (C) of uninsulated portion of cable.
- Wrap the strip of copper foil tightly around uninsulated end of cable and twisted tie wire (D).
- Push the jack plug onto cable over copper foil (E).
- Insert the 1/4-20 setscrews into the center and bottom holes in jack plug and tighten (E).
- Remove cable from vise, and insert jack plug into insulating sleeve. Slide insulating sleeve over jack plug and cable until hole in insulating sleeve lines up with remaining hole in jack plug (F).
- Insert the 8-32 self-tapping screw (F) through hole in insulating sleeve into jack plug and tighten.

3 - 6. WELD POLARITY SELECTION (Figure 4-1)

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source and disconnect input power employing "lockout/tagging procedures" before inspecting or changing connections.

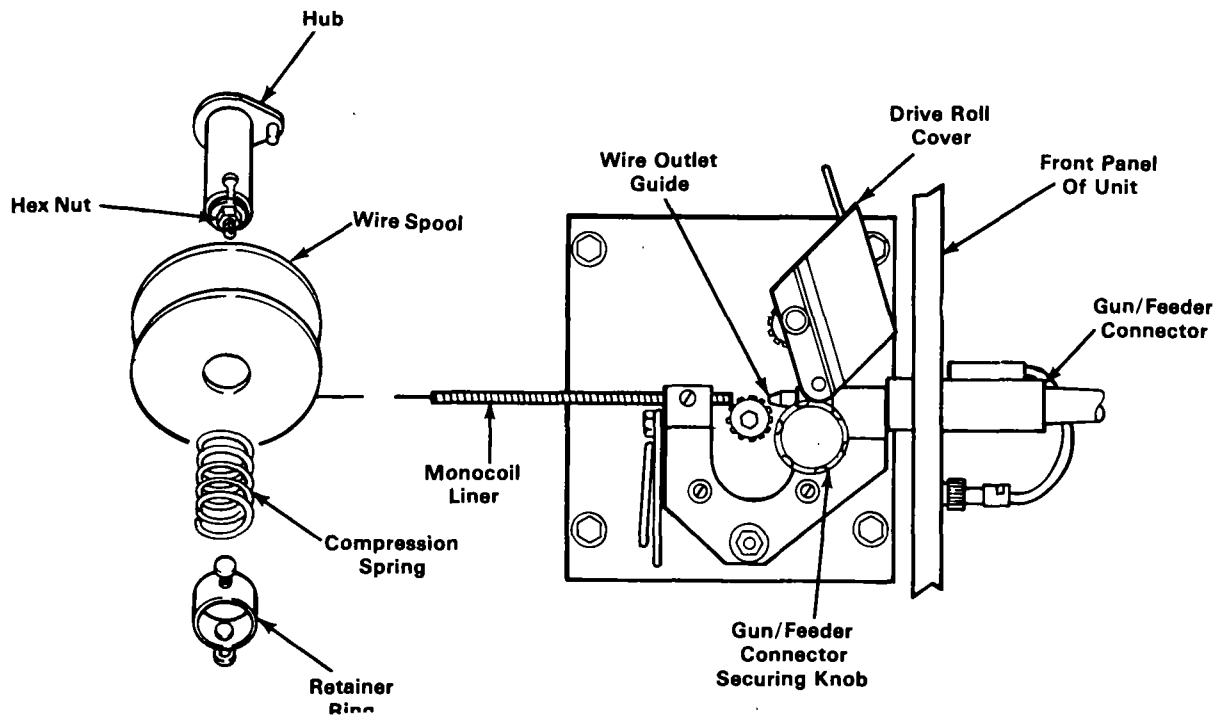
Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

This unit should be connected for Electrode Positive/Reverse Polarity welding for most wire feeding operations. Make cable connections as follows:

- Insert jack plug from work cable into NEGATIVE (-) weld output receptacle, and rotate plug 1/4 turn clockwise.
- Insert jack plug on weld cable from unit into POSITIVE (+) weld output receptacle, and rotate plug 1/4 turn clockwise.

IMPORTANT: When removing jack plugs from receptacles, rotate plug 1/4 turn counterclockwise while withdrawing it from receptacle.

IMPORTANT: For Electrode Negative/Straight Polarity connections, reverse cable connections to weld output terminals; electrode becomes negative.



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Figure 3 - 8. Gun/Feeder Connector And Wire Spool Installation

3 - 7. GA-20C WELDING GUN INSTALLATION (Figures 3-8 And 3-9)

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source and disconnect input power employing "lockout/tagging procedures" before inspecting or installing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

A. Gun/Feeder Connector Installation (Figures 3-8 and 3-9)



IMPORTANT: The outlet guide is provided as part of the gun assembly.

1. Open access door.
2. Loosen the gun/feeder connector securing knob (Figure 3-8).

IMPORTANT: Wire guides should be installed so that the tip of the guide is as close to the drive rolls as possible without touching.

3. Insert the gun/feeder connector, which includes outlet guide, through the access hole in the welding power source front panel and into the drive assembly opposite the wire inlet guide as illustrated in Figures 3-8 and 3-10.
4. Tighten the gun/feeder connector securing knob.
5. Close and secure access door.

B. Gun Switch Connection (Figure 3-9)

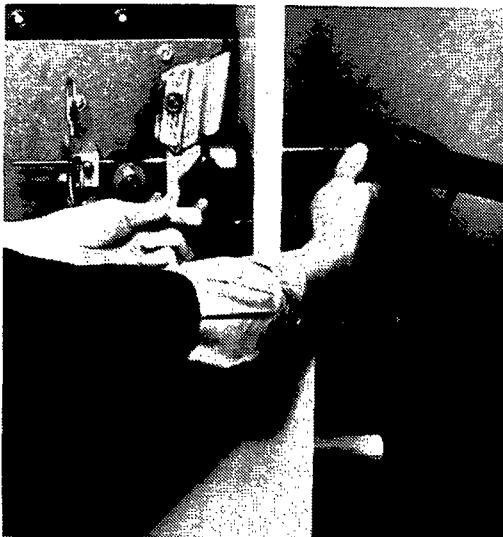
GUN TRIGGER



The GUN TRIGGER receptacle is provided for making switch control connections. Align the keys on the gun switch connector with the keyway on the GUN TRIGGER receptacle, insert connector, and rotate threaded collar fully clockwise. When the gun switch is closed, the welding power source contactor energizes, shielding gas flows, and wire feeds.



A.



B.



C.

Figure 3 - 9. Welding Gun Connections

3 - 8. INSTALLATION OF OPTIONAL SPOOL GUN

WARNING: ELECTRIC SHOCK can kill, ARC SPARKS can cause fire.

- Do not touch live electrical parts.
- Do not connect two guns to this welding power source at the same time.
- Shut down welding power source and disconnect input power employing "lockout/tagging procedures before inspecting or installing.
- Watch for fire.
- Keep a fire extinguisher nearby, and know how to use it.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

If two guns are connected to this welding power source, both electrode wires will be energized when either gun is operated.

A. Shielding Gas Connections

IMPORTANT: Use pure argon shielding gas for aluminum wire welding.

Connect the shielding gas hose from the Spool Gun to the gas regulator/flowmeter on the shielding gas supply. The connector has 5/8-18 right hand threads.

B. Weld Cable Connections (Figure 4-1)

Insert Spool Gun welding cable plug into POSITIVE welding output receptacle with flat side facing the receptacle key. Rotate plug clockwise 1/4 turn.

C. Wire Feed Receptacle Connection (Figure 3-10)

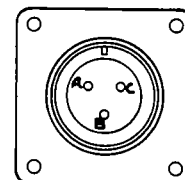
The 3-socket SPOOL GUN receptacle RC3 provides a junction point for connecting a Spool Gun to the control circuitry of the welding power source. To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise.

The sockets on SPOOL GUN receptacle RC3 are designated as follows:

SOCKET A: + 24 volts ac.

SOCKET B: Machine contactor on/off; + 24 volts gives machine output; open (zero volts) equals no output

SOCKET C: + 24 volts ac.



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Figure 3-10. Front View Of 3-Socket Receptacle With Socket Locations

3 - 9. WELDING WIRE SPOOL INSTALLATION (Figure 3-8)

1. Open left side access door.
2. Remove retainer ring from hub assembly.
3. Slide spool of wire onto hub so that wire feeds off bottom of spool.
4. Rotate spool until hole in spool aligns with pin in hub. Slide spool onto hub until it seats against back flange of hub.
5. Compression spring is not required for 12 in. (305 mm) spools. For 8 in. (203 mm) spools, use compression spring. Reinstall retainer ring onto hub.
6. Close and secure access door.

3-10. HUB TENSION ADJUSTMENT (Figure 3-8) - Open left side access door, and check the hub tension by slowly pulling the wire toward the feed roll. The wire should unwind freely, but the hub tension should be sufficient to keep the wire taut and prevent backlash when the wire feeding ceases. If adjustment is required, loosen or tighten the hex nut on the end of the spindle support shaft accordingly. Close and secure side access door.

3-11. ELECTRICAL INPUT CONNECTIONS



INPUT

A. Electrical Input Requirements

This welding power source is designed to be operated from single-phase, 60 Hertz, ac input power which has a voltage rating that matches one of the electrical input voltages shown on the nameplate or input data label. Consult the local electric utility if there is any question about the type of electrical system available at the installation site or how proper connections to the welding power source are to be made.

B. Matching The Welding Power Source To The Available Input Voltage (Figure 3-11)

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source and disconnect input power employing "lockout/tagging procedures" before inspecting or installing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

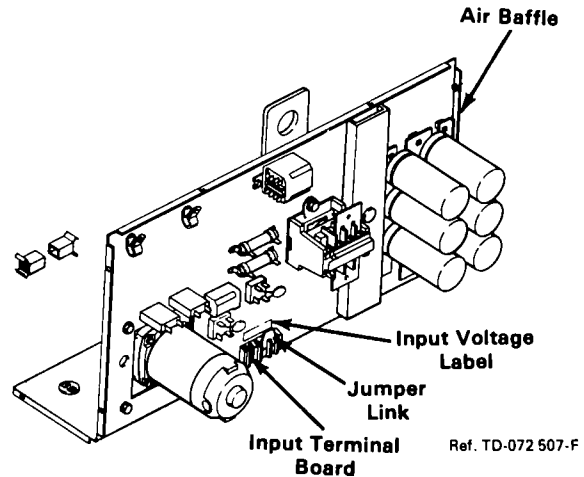


Figure 3-11. Electrical Input Connections

CAUTION: INCORRECT INPUT VOLTAGE JUMPER LINK PLACEMENT can damage unit.

- Position jumper links as shown on the input voltage label located on input terminal board.
- Store unused jumper links across linked terminals.

This welding power source is equipped with input voltage jumper links either installed or in a bag on the input terminal board to allow operation from different line voltages. If installed, the jumper links are positioned for the highest voltage stated on the nameplate or input data label. If in a bag, proper installation is necessary before operation.

Remove the wrapper. Reposition or install if applicable the jumper links onto the input terminal board to match the available line voltage positions shown on the input voltage label (see Figure 3-11). Reinstall wrapper.

C. Wall Receptacle And Power Cable Connections (Figure 3-12)

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Install a fusible line disconnect switch in the input circuit to the welding power source.

The input circuit switch provides a safe and convenient means to completely remove all electrical power from the welding power source whenever it is necessary to inspect or service the unit.

- Employ "lockout/tagging procedures" on input line before making input connections to the welding power source.

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

- When making input power connections, work from welding power source power cable, to wall receptacle, if applicable, to deenergized line disconnect switch. Always work on deenergized circuits when making input power connections.

All models are equipped with a three-conductor power cable. Models requiring 200 or 230 volts input are

equipped with a three-prong polarized plug and wall receptacle. The wall receptacle should be installed in a convenient location by a competent electrician. Install the wall receptacle with the grounding terminal at the top, allowing the power cable to hang downward without undue bending or twisting.

Models having an electrical input voltage above 230 volts have prewired power cables with three conductors. The black and white conductors must be connected to the line disconnect switch and the green conductor must be connected to a proper ground (see Figure 3-12). Use a grounding method that is acceptable to the local electrical inspection authority.

WARNING: ELECTRIC SHOCK can kill.

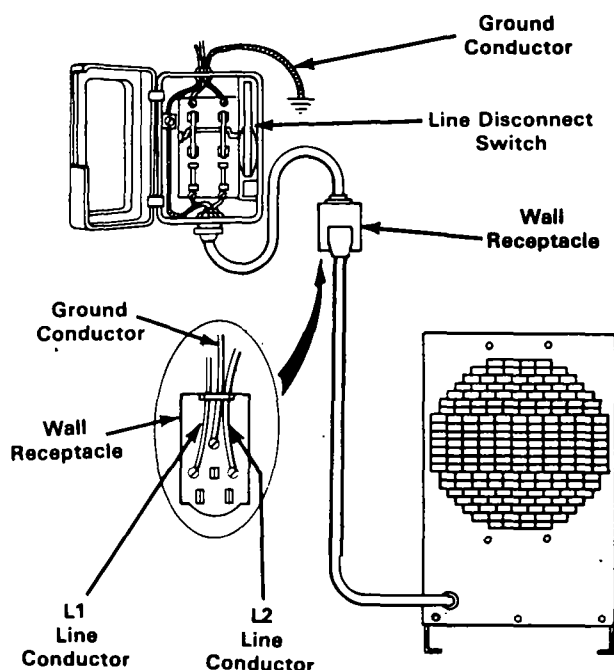
- Do not connect an input (white or black) conductor to the ground terminal.
- Do not connect the ground (green) conductor to an input line terminal.

Incorrect input connections can result in an electrically energized welding power source chassis. The ground conductor is connected to the welding power source chassis and is for grounding purposes only.

Table 3-1. Input Conductor & Fuse Size

Input Conductor Size - AWG*				Fuse Size In Amperes			
200V	230V	460V	575V	200V	230V	460V	575V
10 (10)	10 (10)	14 (14)	14 (14)	40	35	20	15

*Input conductor sizes are based on National Electrical Code specifications for allowable ampacities of insulated copper conductors, having a temperature of 75°C, with not more than three conductors in a raceway or cable. Numbers in () are equipment ground conductor sizes.



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Figure 3-12. Wall Receptacle And Power Cable Connections

3-12. THREADING WELDING WIRE (Figure 3-8)

WARNING: ELECTRIC SHOCK can kill.

- Shut down welding power source and disconnect input power employing "lockout/tagging procedures" before inspecting or installing.
- Do not energize welding power source until instructed to do so.
- Do not touch live electrical parts.

The welding wire is electrically energized whenever the gun trigger is depressed.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

CAUTION: WELDING WIRE can cause puncture wounds; HOT SURFACES can burn skin.

- Do not activate gun trigger until instructed to do so.
- Do not point gun toward any part of the body, other personnel, or any conductive surface when threading welding wire.
- Allow gun to cool before touching.

1. Open left side access door.
2. Install welding wire spool according to Section 3-7.

IMPORTANT: Spooled wire has a tendency to unravel when loosened from the spool. Maintain a firm grip on the wire during the threading operation.

3. Unreel and straighten approximately 6 in. (152 mm) of wire from wire spool.
4. Cut off any wire that is bent, and remove any burrs or sharp edges.
5. Release pressure spring on drive roll assembly, and pivot upper drive roll up, away from lower drive roll.
6. Route welding wire into wire inlet guide, along lower drive roll groove, and into wire outlet guide (see Figure 3-8).
7. Pivot upper drive roll downward onto lower drive roll, and reinstall pressure spring. Be sure that welding wire is in groove of drive rolls.
8. Lay gun cable assembly out as straight and flat as possible.

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.

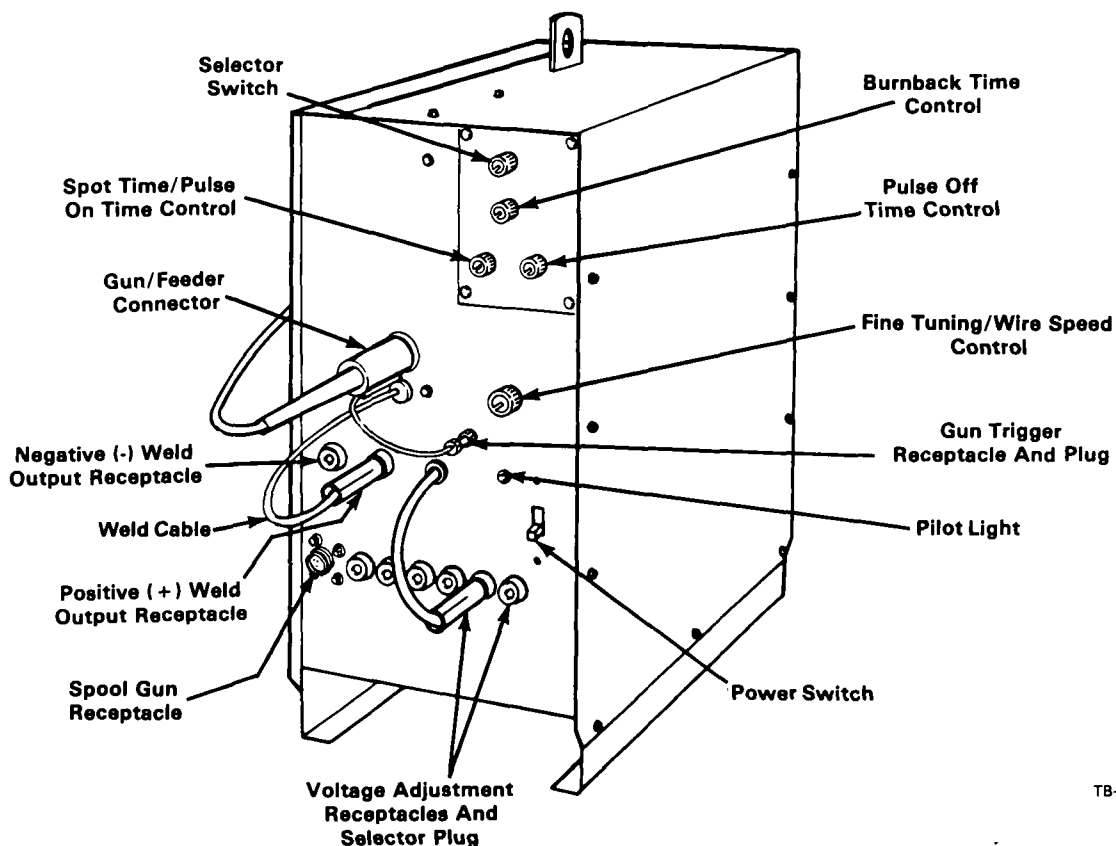
The welding wire is electrically energized whenever the gun trigger is depressed.

WELDING WIRE can cause puncture wounds.

- Do not point gun toward any part of the body, other personnel, or any conductive surface when threading welding wire.

9. Energize welding power source. If power source has spot welding capabilities, place the Selector switch in the CONTINUOUS position.
10. Depress and hold the gun trigger until the wire feeds approximately 1/4 in. (6 mm) out the gun nozzle. If wire feeds more than 1/4 in. out nozzle, cut wire off to 1/4 inch.
11. Deenergize welding power source.
12. Adjust hub tension according to Section 3-9, if necessary.
13. Close and secure access door.

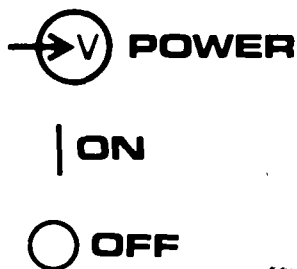
SECTION 4 - OPERATOR CONTROLS



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Figure 4 - 1. Operator Controls

4 - 1. POWER SWITCH (Figure 4-1)



Placing the POWER switch in the ON position energizes the welding power source, making the unit operational. Placing the POWER switch in the OFF position shuts down the unit.

4 - 2. PILOT LIGHT (Figure 4-1) - The pilot light comes on when the POWER switch ON push button is depressed and indicates that the welding power source is energized.

4 - 3. THICKNESS/VOLTS SELECTOR (Figure 4-1)

THICKNESS
VOLTS

CAUTION: ARCING can damage contact surfaces.

- Do not change THICKNESS/VOLTS selector plug position while welding or under load. Arcing causes the contacts to become pitted and eventually inoperative.

The THICKNESS/VOLTS selector jack plug and receptacles provide a selection of heat input to the weld from 1 through 6. The higher the numbered tap the hotter the weld.

IMPORTANT: After installing selector plug into VOLTAGE ADJUSTMENT receptacle, rotate plug 1/4 turn clockwise to secure in place. When removing plug from receptacle, rotate plug 1/4 turn counterclockwise while withdrawing it from receptacle.

4 - 4. FINE TUNING/WIRE SPEED CONTROL (Figure 4-1)



The FINE TUNING/WIRE SPEED control provides a means of varying both the speed of the wire feed motor and weld current of each THICKNESS/VOLTS tap. Rotating the FINE TUNING/WIRE SPEED control in a clockwise direction increases the rate of the wire feed and weld current within the range of the selected THICKNESS/VOLTS tap.

When the FINE TUNING/WIRE SPEED control is set at 0, wire feeds at the slowest speed and weld current is at minimum in the selected range; when set at 100, the wire feeds at the fastest speed and weld current is at maximum in that range.

The scale surrounding the FINE TUNING/WIRE SPEED control is a relative scale only; it does not represent an actual inches per minute or weld current value.

IMPORTANT: The FINE TUNING/WIRE SPEED control may be adjusted while welding.

IMPORTANT: In the PULSE mode, the FINE TUNING/WIRE SPEED control must be set at 50 percent or less when using THICKNESS/VOLTS taps 5 and 6.

4 - 5. FAN-ON-DEMAND

FAN CONTROLLED BY THERMOSTAT

Fan motor FM is thermostatically controlled to provide fan cooling of main transformer T1 and rectifier assembly SR1 if these components require cooling. The fan will run only when cooling is required. Two normally-open thermostats, TP1 in rectifier assembly SR1 and TP2 in main transformer T1, and relay CR2, regulate fan motor operation. When the main transformer and/or rectifier assembly heat up enough to close thermostat(s) TP1 and/or TP2, fan relay CR2 energizes, energizing the fan motor. The fan motor will continue to operate until the main transformer and/or rectifier assembly have cooled enough to permit thermostats TP1 and TP2 to open or until the welding power source is shut down.

4 - 6. CIRCUIT BREAKERS

Two circuit breakers, located behind the access door immediately above the drive roll assembly, are provided to protect the welding power source in the event of an overload. Circuit breaker CB1 protects the motor armature and circuit breaker CB2 protects the welding power source control circuitry. If either circuit breaker opens, wire feeding stops. See Section 6-8 for resetting circuit breakers.

4 - 7. OPTIONAL SPOT PULSE PANEL CONTROLS (Figure 4-1)

IMPORTANT: In the PULSE mode, the WIRE SPEED FINE ADJUSTMENT control must be set at 50 percent or less when using VOLTAGE ADJUSTMENT taps 5 and 6.

A. Selector Switch

The Selector switch enables the operator to select continuous, spot, or pulsed wire feed operation.

1. Continuous Position

Placing the Selector switch in the CONTINUOUS position and depressing the gun trigger feeds welding wire for as long as the gun trigger remains closed.

2. Spot Position

Placing the Selector switch in the SPOT position and depressing the gun trigger feeds welding wire for the length of time set on the SPOT TIME control.

3. Pulse Position

Placing the Selector switch in the PULSE position and depressing the gun trigger feeds welding wire for the length of time set on the PULSE ON TIME control. At the end of the pulse on time, welding wire stops feeding for the length of time set on the PULSE OFF TIME control. The welding wire continues to pulse feed on and off for the selected times until the gun trigger is released. The pulse option provides better control of the heat input to the weld on thin gauge metals, thereby decreasing distortion and the likelihood of melt-throughs.

B. Spot Time/Pulse On Time Control

The SPOT TIME/PULSE ON TIME control enables the operator to select from 0.5 to 4 seconds of weld time for spot operation or 0.25 to 2 seconds of pulse time for pulse operation. Rotating the control clockwise increases spot/pulse on time. The control scale is calibrated in percent and does not indicate actual spot/pulse on times.

C. Pulse Off Time Control

The PULSE OFF TIME control enables the operator to select from 0.25 to 1 second of pulse off time for pulse operation. Rotating the control clockwise increases pulse off time. The control scale is calibrated in percent and does not indicate actual pulse off time.

D. Burnback Time Control

The BURNBACK TIME control provides a means of adjusting the time period (up to a maximum of 0.25 seconds) that the welding wire remains electrically energized after the wire feeding has stopped.

By adjusting this control properly, the welding wire will neither freeze in the weld puddle nor in the contact tube of the gun. If the welding wire freezes to the work, increase the burnback time. If the welding wire burns back into the contact tube, decrease the burnback time. Rotate the control clockwise to increase the burnback time, and rotate the control counterclockwise to decrease the burnback time. The scale surrounding the control is calibrated in percent and does not represent an actual burnback time.

SECTION 5 - SEQUENCE OF OPERATION

WARNING: ELECTRIC SHOCK can kill; MOVING PARTS can cause serious injury; IMPROPER AIR FLOW AND EXPOSURE TO ENVIRONMENT can damage internal parts.

- Do not touch live electrical parts.
- Keep clear of pinch points.
- Keep all covers and panels in place while operating.

Warranty is void if the wire feeder is operated with any portion of the outer enclosure removed.

ARC RAYS, SPARKS, AND HOT SURFACES can burn eyes and skin; **NOISE** can damage hearing.

- Wear correct eye, ear, and body protection.

FUMES AND GASES can seriously harm your health.

- Ventilate to keep from breathing fumes and gases.
- If ventilation is inadequate, use approved breathing apparatus.

WELDING WIRE can cause puncture wounds.

- Do not point gun toward any part of the body, any conductive surface, or other personnel.

HOT METAL, SPATTER, AND SLAG can cause fire and burns.

- Watch for fire.
- Have a fire extinguisher nearby, and know how to use it.
- Allow work and equipment to cool before handling.

MAGNETIC FIELDS FROM HIGH CURRENTS can affect pacemaker operation.

- Wearers should consult with their doctor before going near arc welding, gouging, or spot welding operations.

See Section 1 - Safety Rules For Operation Of Arc Welding Power Source for basic welding information.

5 - 1. GAS METAL ARC WELDING (GMAW) - CONTINUOUS AND GAS METAL ARC WELDING-PULSED ARC (GMAW-P)

WARNING: Read and follow safety information at beginning of entire Section 5 before proceeding.

1. Install and connect unit according to Section 3.

IMPORTANT: Be sure that work cable is installed into NEGATIVE (-) weld output receptacle and weld cable from unit is installed into POSITIVE (+) weld output receptacle.

2. Thoroughly clean joint area of workpiece.

CAUTION: WELDING CURRENT can damage vehicle computers and other electronic components.

- Disconnect both battery cables before welding on a vehicle.
- Place work clamp as close to the weld as possible to avoid long electrical paths.
- Be sure gun to power source as well as cable connections to work clamp are clean and tight.
- To be 100 percent free of risk, disconnect the computer(s) from the vehicle.

3. Connect work clamp to workpiece.

4. Turn on shielding gas at the source.

5. Open drive roll housing to prevent wire feed, and purge and adjust gas system as follows:

- a. Open left side access door, release pressure spring on drive roll assembly, and pivot upper drive roll up, away from lower drive roll.

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Do not touch welding wire or any metal part in contact with it while welding.

The welding wire and all metal parts in contact with it carry weld current whenever the gun trigger is depressed.

- b. Energize welding power source, and depress gun trigger for approximately 15 seconds to adjust regulator/flowmeter and to purge the gas hose.

Table 5 - 1. Voltage Adjustment Jack Plug Positions For Mild Steel

Voltage Adjustment Receptacle		1	2	3	4	5	6
METAL THICKNESS	GAUGES	22-18	18-16	16-14	14-12	12-10	10 Or. Heavier
	INCHES	.035 +	.047 +	.059 +	.067 +	.104 +	.134 +
	MILLIMETERS	.8 +	1.2 +	1.5 +	1.9 +	2.6 +	3.4 +
*AMPERAGE For .030 in. (0.8mm) WIRE		30-55	55-85	85-105	105-130	130-150	150-180
*AMPERAGE For .035 in. (0.9mm) WIRE		35-65	65-95	95-115	115-140	140-180	175-220

*Amperage values are obtained by adjusting the WIRE SPEED FINE ADJUSTMENT Control.

IMPORTANT: Shielding gas flow rate of 15 to 25 cfh is typical. Welding out of position at high wire feed speeds or welding in a drafty environment will require more shielding gas.

- c. Deenergize welding power source.
 - d. Close drive roll housing as follows: pivot upper drive roll down onto lower drive roll, and reinstall pressure adjustment spring onto pin on top drive roll cover.
 - e. Close and secure side access door.
6. If applicable, place the Selector switch on the optional SPW-1 Panel in the CONTINUOUS position if continuous welding, and place the switch in the PULSE position if pulse welding (see Section 4-7).
 7. If pulse welding, rotate the SPOT TIME/PULSE ON TIME and PULSE OFF TIME controls to desired settings (see Section 4-7).
 8. Place the THICKNESS/VOLTS selector jack plug in the appropriate THICKNESS/VOLTS receptacle for the thickness of metal being welded (see Section 4-3 and Table 5-1).

IMPORTANT: It is important that the selected voltage be appropriate for type of weld and thickness of material. Be sure that the weld bead is thoroughly fused with the base metal along the total length of the bead. If the weld bead does not penetrate the base metal, increase the weld voltage. If the edges of the bead cut into the base metal, decrease weld voltage.

9. Rotate the FINE TUNING/WIRE SPEED control to 50. (The control can be adjusted as required while welding.)
10. Energize welding power source.

11. Be sure welding wire extends approximately 1/4 in. (6.4 mm) out gun nozzle, position gun over joint, lower welding helmet, and depress gun trigger.

IMPORTANT: The welding wire is not energized until the gun trigger is pressed; therefore, the operator can accurately position gun on weld joint before lowering helmet and pressing gun trigger.

12. Readjust FINE TUNING/WIRE SPEED control as necessary.

IMPORTANT: Adjust the wire speed to keep weld spatter at a minimum while maintaining a steady, quick-crackling sounding arc. (When optimum arc length is reached, arc will sound like frying bacon).

13. If pulse welding, readjust SPOT TIME/PULSE ON TIME and PULSE OFF TIME controls as necessary.

5 - 2. GAS METAL ARC WELDING (GMAW)-SPOT (Models With Optional SPW-1 Panel Only)

WARNING: Read and follow safety information at beginning of entire Section 5 before proceeding.

1. Install and connect unit according to Section 3.
2. Thoroughly clean joint area of workpiece.

CAUTION: WELDING CURRENT can damage vehicle computers and other electronic components.

- Disconnect both battery cables before welding on a vehicle.
- Place work clamp as close to the weld as possible to avoid long electrical paths.
- Be sure gun to power source as well as cable connections to work clamp are clean and tight.
- To be 100 percent free of risk, disconnect the computer(s) from the vehicle.

3. Connect work clamp to work piece.
4. Turn on shielding gas at the source.
5. Adjust shielding gas pressure, and purge shielding gas hose as follows:
 - a. Open left side access door of unit, release pressure spring on drive roll assembly, and pivot upper drive roll up, away from lower drive roll.

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Do not touch welding wire or any metal part in contact with it while welding.

Welding wire and all metal parts in contact with it carry weld current whenever the gun trigger is depressed.

- b. Energize welding power source, and depress gun trigger for approximately 15 seconds to adjust the regulator/flowmeter and to purge the gas hose.

IMPORTANT: Shielding gas flow rate of 15 to 25 cfh is typical. Welding out of position at high wire feed speeds or welding in a drafty environment will require more shielding gas.

- c. Deenergize welding power source.
 - d. Pivot upper drive roll down onto lower drive roll, and reinstall pressure adjustment spring onto pin on top drive roll cover.
 - e. Close and secure side access door.
6. Set spot weld parameters (weld voltage, wire feed speed, spot weld time, and burnback time) as follows:
 - a. Obtain sample pieces of metal the same type, but approximately twice the thickness of the final workpiece.
 - b. Place Selector Switch on optional SPW-1 panel in CONTINUOUS position, and set welding voltage and wire feed speed parameters according to Steps 8 thru 12 in Section 5-1. (Set voltage and wire feed speed for metal thickness of sample metal.)
 - c. After voltage and wire feed speed parameters have been set, deenergize welding power source, remove continuous welding nozzle from gun, and replace nozzle with appropriate spot welding nozzle.

- d. Obtain sample metal of the same type and thickness of final workpiece.
- e. Place welding power source in SPOT mode, and rotate SPOT TIME/PULSE ON TIME and BURNBACK TIME controls to desired

IMPORTANT: The correct burnback time allows the wire to burn back just free of the weld puddle. If the welding wire freezes to the workpiece at the end of the weld cycle, increase burnback time. If the welding wire burns back into the contact tube, decrease burnback time. If the wire burns back into the contact tube, it may be necessary to replace the contact tube in the gun. (see gun Owner's Manual for contact tube replacement procedure.)

- f. Make several practice spot welds to determine if weld parameters are set correctly. (Refer to Table 5-2 to check sample weld.)

To spot weld, place gun nozzle directly on workpiece, hold gun motionless, and depress gun trigger. When trigger is depressed, welding wire and shielding gas well feed for the length of time set on the SPOT TIME/PULSE ON TIME Control.

IMPORTANT: The welding wire is not energized until the gun trigger is pressed, therefore, the operator can accurately position gun on weld joint before lowering helmet and pressing gun trigger.

IMPORTANT: The gun trigger must be held closed until the SPOT TIME/PULSE ON TIME control has timed out, completing the spot weld cycle. If the trigger is released before the cycle is complete, the cycle stops, and the unit resets for another weld cycle.

7. After all weld parameters have been set, weld final workpiece.

5 - 3. SHUTTING DOWN

1. Stop welding.
2. Shut down welding power source.
3. Turn off shielding gas at the source.

WARNING: HIGH CONCENTRATION OF SHIELDING GAS can harm health or kill.

- Shut off gas supply when not in use.

Table 5 - 2. Checking Weld Parameters

Weld Appearance	Cause	Correction Procedure
Dark blue circle or small protrusion visible on reverse side of weld.	Voltage and wire feed speed parameters are set correctly.	None.
Small burn-through on reverse side of weld.	Voltage and wire feed speed parameters are set correctly, but spot time too long.	Decrease SPOT TIME/PULSE ON TIME Control setting.
Excessive burn-through on reverse side of weld.	Welding voltage set too high.	Repeat Steps 6a thru f in Section 5-2 to reset voltage and wire feed speed parameters.
No dark blue circle or small protrusion on reverse side of weld, but when welded pieces are pulled apart, a small hole is torn in bottom piece of metal.	Voltage and wire feed speed parameters set correctly, but spot time too short.	Increase SPOT TIME/PULSE ON TIME Control setting.
No dark blue circle or small protrusion on reverse side of weld, and when welded pieces are pulled apart, there is minimal penetration into lower piece of metal.	Welding voltage set too low.	Repeat Steps 6a thru f in Section 5-2 to reset voltage and wire feed speed parameters.

SECTION 6 - MAINTENANCE & TROUBLESHOOTING

IMPORTANT: *Every six months inspect the labels on this unit for legibility. All precautionary labels must be maintained in a clearly readable state and replaced when necessary. See the Parts List for part number of precautionary labels.*

6 - 1. FAN MOTOR - This unit is equipped with an exhaust fan and relies on forced draft for adequate cooling. The fan motor is manufactured with lifetime sealed bearings and requires no maintenance.

6 - 2. INSPECTION AND UPKEEP - Usage and shop conditions will determine the frequency and type of maintenance. At minimum, inspect equipment every three months as follows:

WARNING: **ELECTRIC SHOCK** can kill.

- *Do not touch live electrical parts.*
- *Shut down unit and disconnect input power employing "lockout/tagging procedures" before inspecting, maintaining, or servicing.*

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

HOT SURFACES can cause severe burns.

- *Allow cooling period before servicing.*

1. Inspect all cables and hoses for damage or breaks in the insulation jacket, particularly at the plugs or ends. Repair or replace cable(s) or hoses as necessary.
2. Remove grease and dirt from components, and remove moisture from electrical parts and cables.
3. Be sure that all connections are clean and tight.

6 - 3. INTERNAL CLEANING

WARNING: **ELECTRIC SHOCK** can kill.

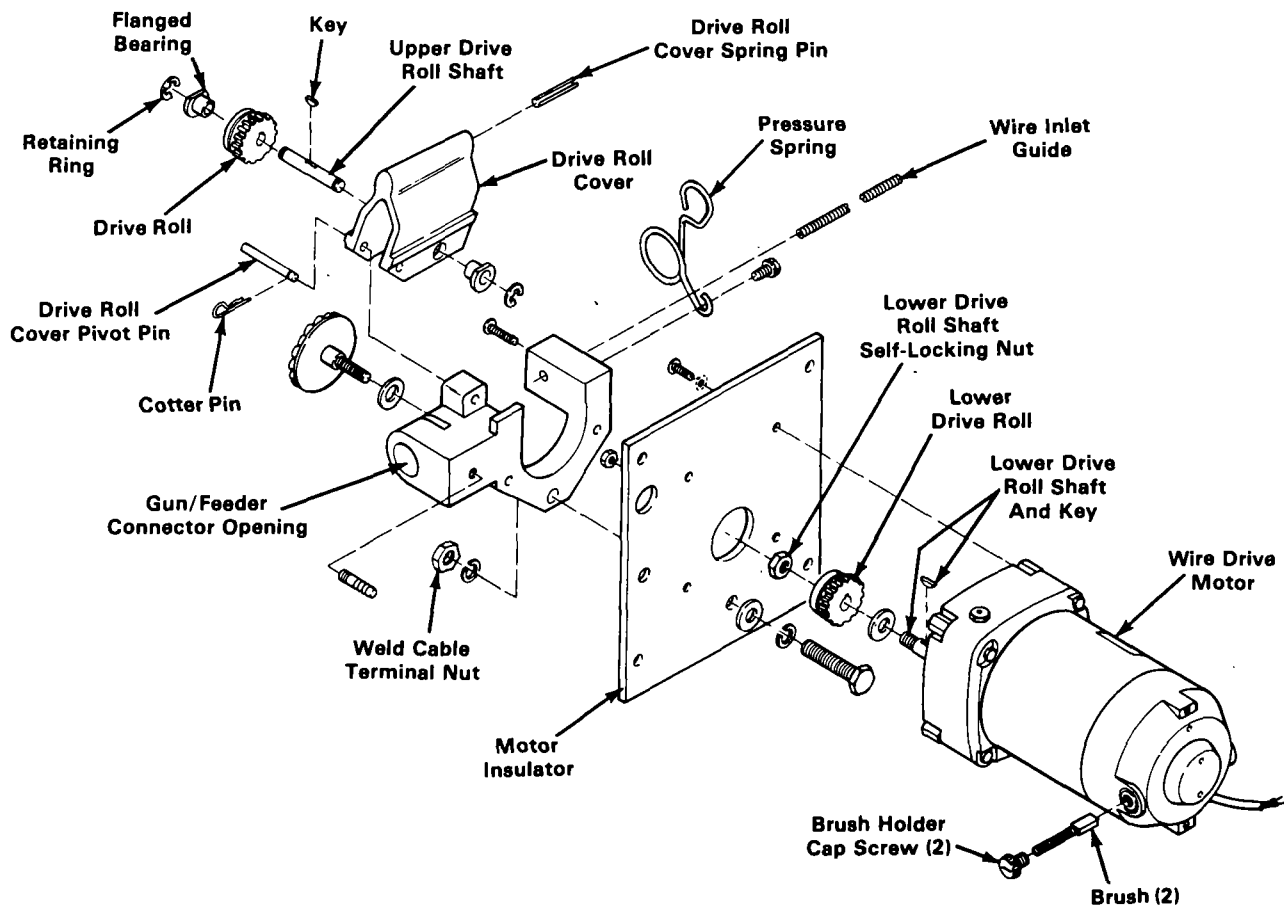
- *Do not touch live electrical parts.*
- *Shut down welding power source and disconnect input power employing "lockout/tagging procedures" before inspecting, maintaining, or servicing.*

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

HOT SURFACES can cause severe burns.

- *Allow cooling period before servicing.*

Annually blow out or vacuum dust and dirt from around welding power source internal components. If dirty or dusty conditions are present, clean unit monthly.



TC-072 511

Figure 6 - 1. Replacing Drive Rolls And Motor Brushes

6 - 4. CLEANING DRIVE ROLLS (Figure 6-1)

IMPORTANT: Failure to properly maintain the drive rolls can result in a buildup of wire particles which will decrease the efficiency of the wire feeding operation.

Every time welding wire is installed or changed, inspect the wire groove on each drive roll for a buildup of wire particles.

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Keep clear of pinch points.
- Shut down welding power source and disconnect input power employing "lockout/tagging procedures" before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

1. Open left side access door.
2. Remove drive rolls according to Section 6-5.

WARNING: HIGH ROTATIONAL SPEED may cause damage to drive rolls and injure personnel.

- Do not allow drive rolls to rotate at high speed if compressed air is used for cleaning drive roll assembly.
3. Using a wire brush, clean the drive roll groove in each drive roll.
 4. Reinstall the drive rolls into the unit according to Section 6-5.
 5. Close and secure side access door.
 6. Resume operation.

6 - 5. REPLACING DRIVE ROLL AND WIRE INLET GUIDE (Figure 6-1) - As a result of wear or a change in wire size, it may be necessary to replace the drive rolls and wire inlet guide. Proceed as follows:

A. Replacing Upper Drive Roll

1. Disassembly
 - a. Open and secure left side access door.
 - b. Release pressure spring from spring pin on drive roll cover.

- c. Remove cotter pin from drive roll cover pivot pin.
- d. Remove pivot pin, thereby freeing drive roll cover from drive assembly.
- e. Remove retaining ring and flanged bearing from one end of drive roll shaft.
- f. Push drive roll shaft out drive roll cover until drive roll falls from cover. Be sure that key remains in slot in drive roll shaft.

2. Assembly

- a. Install drive roll into drive roll cover with gear section of drive roll facing the rear of the cover (side facing motor insulator). Be sure to align clearance hole in drive roll with the two shaft clearance holes in drive roll cover.
- b. Align key in drive roll shaft with keyway in drive roll, and route end of drive roll shaft without retaining ring and bearing through hole in rear side of drive roll cover, through drive roll, and out front side of cover.
- c. Reinstall flanged bearing and retaining ring removed in Step 1e onto end of drive roll shaft.
- d. Reinstall drive roll cover and pivot pin into drive roll assembly.
- e. Reinstall cotter pin onto pivot pin.
- f. If installing or changing lower drive roll, proceed to Section 6-5B; otherwise, reengage pressure spring over spring pin on drive roll cover, and close and secure access door.

B. Replacing Lower Drive Roll

1. Disassembly

- a. If applicable, release pressure spring from spring pin on drive roll cover.
- b. If applicable, pivot upper drive roll up, away from lower drive roll.

- c. Remove self-locking nut from end of lower drive roll shaft, and remove drive roll. Be sure that key remains in slot in drive roll shaft.

2. Assembly

- a. Install drive roll onto lower drive roll shaft aligning keyway in drive roll clearance hole with key in drive roll shaft. (Drive roll must be installed with gear section facing the motor insulator.)
- b. Reinstall self-locking nut onto drive roll shaft.
- c. Adjust horizontal position of lower drive roll in or out as necessary. To move the drive roll in towards the motor insulator, rotate the self-locking nut clockwise. To move the drive roll out away from the center panel of the unit, rotate the nut counterclockwise.

IMPORTANT: *Be sure that upper and lower drive roll gears are properly meshed and the drive roll grooves are aligned when adjusting horizontal position of lower drive roll.*

- d. Reengage pressure spring over spring pin on drive roll cover.
- e. If replacing wire inlet guide, proceed to Section 6-5C; otherwise, close and secure side access door.

C. Replacing Wire Inlet Guide

- 1. Loosen wire guide securing screw.
- 2. Remove wire guide from drive housing.
- 3. Install new wire guide through mounting hole in left side of drive housing (see Figure 6-1).

IMPORTANT: *Wire guide should be installed as close to the drive rolls as possible without touching them.*

- 4. Tighten wire guide securing setscrew.
- 5. Close and secure side access door.

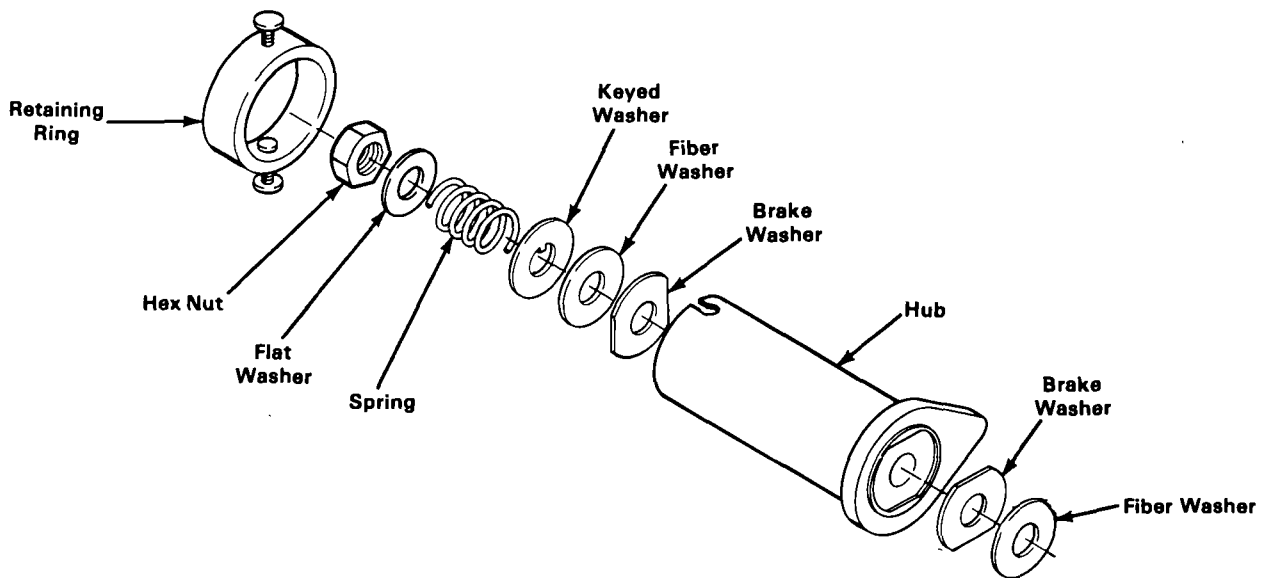


Figure 6 - 2. Hub Assembly

Ref. TD-072 509-D

6 - 6. REALIGNING DRIVE HOUSING (Figure 6-1)

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source and disconnect input power employing "lockout/tagging procedures" before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

The wire drive housing is made with mounting holes of sufficient clearance to provide adjustment of the wire guides up or down in relation to the drive rolls. This adjustment has been factory set, but if readjustment becomes necessary proceed as follows:

1. Open left side access door.
2. Loosen drive housing mounting screws and the weld cable terminal nut securing wire drive housing to the air baffle.
3. Slide drive housing up or down until the wire can be fed straight through the wire inlet guide and wire outlet guide while wire is seated in drive roll groove.
4. Tighten mounting screw and weld terminal nut.
5. Close and secure access door.

6 - 7. REPLACING HUB ASSEMBLY (Figure 6-2) - If it should become necessary to replace part or all of the hub assembly, reinstall the new hub assembly as follows:

1. Slide the following items onto the spindle support shaft in order given:
 - a. Fiber Washer
 - b. Brake Washer
 - c. Hub
 - d. Brake Washer
 - e. Fiber Washer
 - f. Keyed Washer
 - g. Spring
 - h. Flat Washer
2. Rotate hex nut onto support shaft. Hex nut should be rotated only until a slight drag is felt while turning hub.
3. Install welding wire according to Section 3-9.
4. Reinstall retaining ring onto hub.

6 - 8. RESETTING CIRCUIT BREAKERS CB1 AND CB2

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source and disconnect input power employing "lockout/tagging procedures" before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

Circuit breakers CB1 and CB2 are provided to protect the welding power source in the event of an overload. Circuit breaker CB1 protects the motor armature, and CB2 protects the welding power source control circuitry. When the circuit breakers are in (ON position), the circuit breakers are functional. When the circuit breakers are out (OFF position), the circuit breakers are open. If CB1 and/or CB2 open, wire feeding stops. Reset CB1 and/or CB2 as follows:

1. Open left side access door.
2. Check for jammed wire or clogged gun liner, and correct problem. If motor overload happens often, repair or replace the motor or liner.
3. Check for binding drive gear or misaligned drive rolls, and correct problem.
4. Reset circuit breaker(s) (depress button); it may be necessary to allow a cooling period before the breaker can be reset.
5. Close and secure access door.
6. Resume operation.

6 - 9. RECTIFIER PROTECTION (Thermal Shut-down) - Rectifier SR3 is protected from overheating by a normally-closed thermostat TP3 wire in the relay CR1 and contactor W coil circuit. Should overheating occur, TP3 would open causing CR1 and thereby the contactor to drop out (deenergize) thereby stopping all weld output. If this condition occurs, it will be necessary to allow a cooling period before resuming operation.

6 - 10. INSPECTING AND REPLACING MOTOR BRUSHES (Figure 6-1)

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source and disconnect input power employing "lockout/tagging procedures" before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

1. Open left side access door.
2. Remove the two brush holder cap screws.
3. Remove brushes.

4. Examine brushes, and replace them if they are chipped or broken or if less than 1/4 in. (6.4 mm) of brush material remains.
5. Install brushes, and reinstall brush holder cap screws.

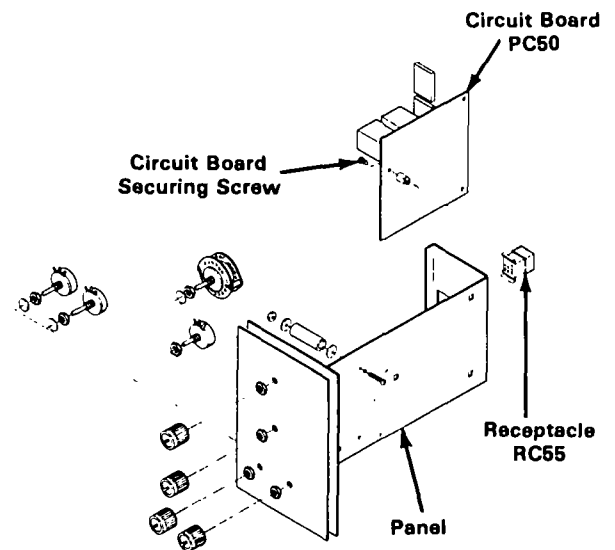
CAUTION: DISASSEMBLY OF MOTOR FIELD MAGNETS can result in personal injury and equipment damage.

- Limit wire drive motor repairs to brush replacement.

The field magnets are very strong. If disassembly is attempted, injury to fingers and hands may result from the magnets drawing the armature back into the motor. The field magnets are matched sets and operation may be affected if the magnets are tampered with. Warranty is void if the motor is tampered with.

6. Close and secure access door.

6-11. REPLACING SPW-1 PANEL CIRCUIT BOARD (Figure 6-3)



TC-086 924-A

Figure 6 - 3. SPW-1 Panel Components

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source and disconnect input power employing "lockout/tagging procedures" before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

If the printed circuit board is at fault for a problem with the unit, replace the board using the following procedure. Do not attempt board repair. Contact the nearest Factory Authorized Service Station for correct replacement part.

CAUTION: ELECTROSTATIC DISCHARGE can damage circuit board components.

- Put on properly grounded wrist strap *BEFORE* handling circuit boards.
- Transport all static-sensitive components in proper static-shielding carriers or packages.
- Perform work only at a static-safe work area.

IMPORTANT: All directions, such as left or right, are with respect to the operator facing the unit front panel. Retain all hardware removed during this procedure for reinstallation unless specifically told otherwise.

1. Remove screws securing SPW-1 Panel to welding power source front panel.
2. Pull SPW-1 Panel out of unit.
3. Disconnect wiring harness plug PLG2 from receptacle RC55 on SPW-1 Panel, and remove panel from unit.
4. Remove screws securing circuit board PC50 to SPW-1 Panel, and remove circuit board.
5. Install new circuit board PC50 to panel using securing screws removed in Step 5.
6. Reconnect wiring harness plug PLG2 to receptacle RC55 on SPW-1 Panel, and reinstall panel into welding power source.

6-12. REPLACING SPW-1 PANEL

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source and disconnect input power employing "lockout/tagging procedures" before inspecting, maintaining, or servicing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

CAUTION: ELECTROSTATIC DISCHARGE can damage circuit board components.

- Put on properly grounded wrist strap *BEFORE* handling circuit boards.
- Transport all static-sensitive components in proper static-shielding carriers or packages.
- Perform work only at a static-safe work area.

IMPORTANT: All directions, such as left or right, are with respect to the operator facing the unit front panel. Retain all hardware removed during this procedure for reinstallation unless specifically told otherwise.

1. Remove screws securing SPW-1 Panel to welding power source front panel.
2. Pull SPW-1 Panel out of unit.
3. Disconnect wiring harness plug PLG2 from receptacle RC55 on SPW-1 Panel, and remove panel from unit.
4. Connect wiring harness plug PLG2 to receptacle RC55 on new SPW-1 Panel, and install panel into welding power source.
5. Secure SPW-1 Panel to welding power source using screws removed in Step 1.

6-13. TROUBLESHOOTING CHART

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down welding power source and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.

Lockout/tagging procedures consist of removing input power plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- Keep clear of moving parts.

HOT SURFACES can cause severe burns.

- Allow cooling period before servicing.

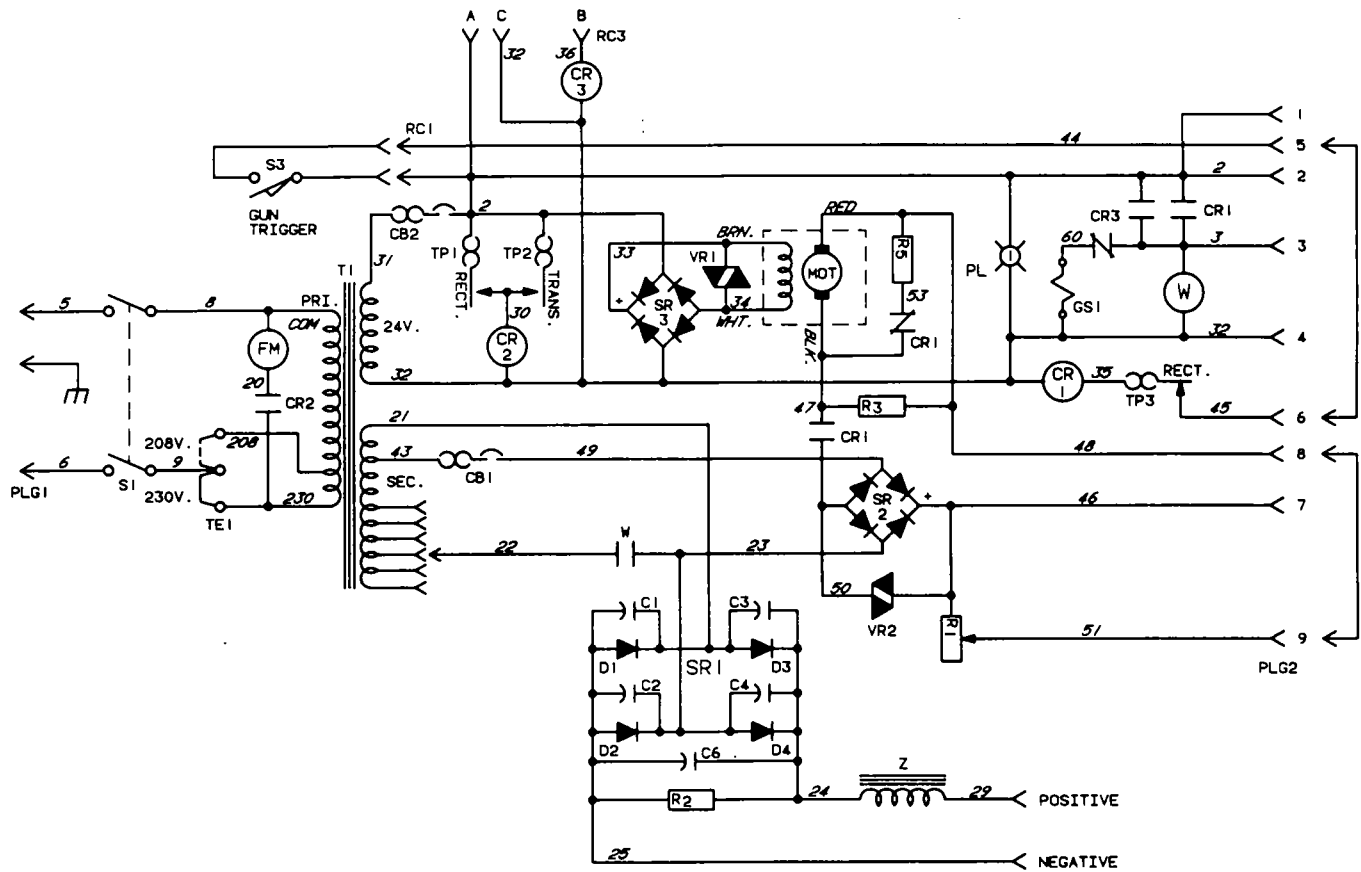
Troubleshooting to be performed only by qualified persons.

It is assumed that the unit was properly installed according to Section 3 of this manual, the operator is familiar with the function of controls, the welding power source was working properly, and that the trouble is not related to the welding process. The following chart is designed to diagnose and provide remedies for some of the troubles that may develop in this welding power source.

Use this chart in conjunction with the circuit diagram while performing troubleshooting procedures. If the trouble is not remedied after performing these procedures, the nearest Factory Authorized Service Station should be contacted. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly followed.

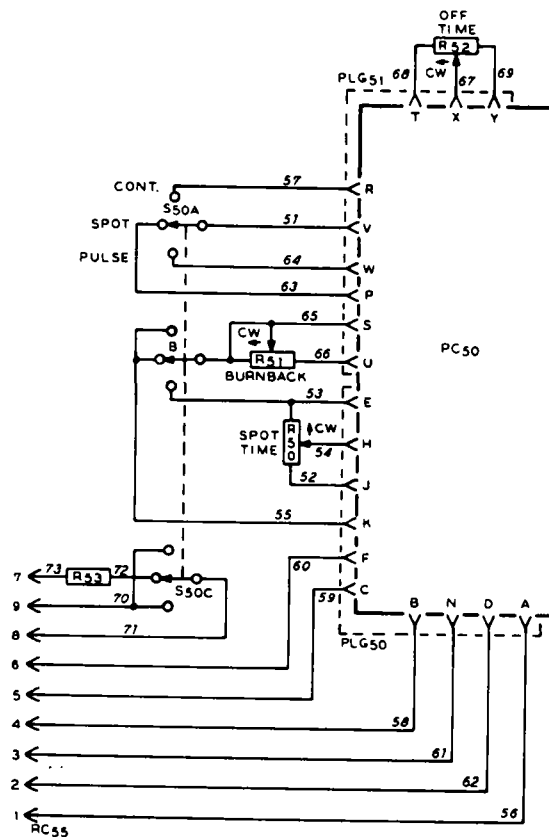
TROUBLE	PROBABLE CAUSE	REMEDY
No weld output; wire does not feed.	Line Disconnect Switch in Off position.	Place Line Disconnect Switch in On position.
	Improper electrical input connections.	See Section 3-11 for proper input connections.
	Input voltage jumper links not in proper position.	See Section 3-11 for proper jumper link position.
	Line fuse(s) open.	Check and replace open line fuses.
	Gun switch, or gun switch leads.	See gun Owner's Manual.
	POWER switch S1.	Replace S1.
	Switch control relay CR1.	Replace CR1.
No weld output; wire feeds.	Main rectifier SR1 overheating (thermal shut-down).	Allow rectifier to cool down (see Section 6-9).
	THICKNESS/VOLTS plug not secure in receptacle.	Secure connection.
	Work clamp connection loose or incomplete due to rust, paint, etc. on surface of workpiece.	Check work connection for good metal to metal contact.
	Contact tube.	See gun Owner's Manual.
Low weld output.	Low input voltage.	Check for proper input voltage.
	Input voltage jumper link not in proper position.	See Section 3-11 for proper jumper link position.
Electrode wire stops feeding while welding.	Circuit breaker CB2.	Check and reset CB2 if necessary (see Section 6-8).
	Sharp or excessive bend in gun cables or liners.	Straighten gun cables and/or replace liners (see gun Owner's Manual).
	Incorrect hub tension.	Readjust hub tension (see Section 3-10).
	Contact tube opening restricted; burnback of wire into tube.	See gun Owner's Manual.
	Friction in gun.	See gun Owner's Manual.
	Gun liner dirty, restricted.	See gun Owner's Manual.
	Broken or damaged gun liner.	See gun Owner's Manual.
	Worn drive rolls.	Replace drive rolls according to Section 6-5.
	Drive rolls misaligned.	Realign drive rolls according to Section 6-5 and/or 6-6.

TROUBLE	PROBABLE CAUSE	REMEDY
Electrode wire stops feeding while welding.	Excessive loading of drive motor.	Clear restriction in drive assembly.
	Drive motor brushes.	Check and replace brushes if necessary (see Section 6-10).
	Drive motor M.	Check and replace motor if necessary.
	Gun trigger switch in-operative or leads broken.	See gun Owner's Manual.
Unit shuts down while welding.	Fan motor FM.	Check and replace FM if necessary.
No open-circuit voltage.	THICKNESS/VOLTS plug not secure in receptacle.	Secure plug in receptacle.
	Contactor W points.	Contact nearest Factory Authorized Service Station.
	Gun switch.	See gun Owner's Manual.
	Transformer T1.	Contact nearest Factory Authorized Service Station.
	Plug PLG2 not secure in receptacle RC55 (models with optional Spot Weld Panel only).	Secure PLG2 into RC55.
Wire does not feed; open circuit voltage normal.	Circuit breaker CB1 or CB2.	Reset CB1 or CB2 (see Section 6-8).
	Rectifier SR2.	Contact nearest Factory Authorized Service Station.
	Wire feed motor M.	Replace M.
Spot weld timer does not time out (models with SPW-1 panel).	SPW-1 panel.	Replace SPW-1 circuit board PC50 (see Section 6-11), or replace SPW-1 Panel, if necessary (see Section 6-12).
Pulsed wire feed operation not available.	SPW-1 panel.	Replace SPW-1 circuit board PC50 (see Section 6-11), or replace SPW-1 Panel, if necessary (see Section 6-12).



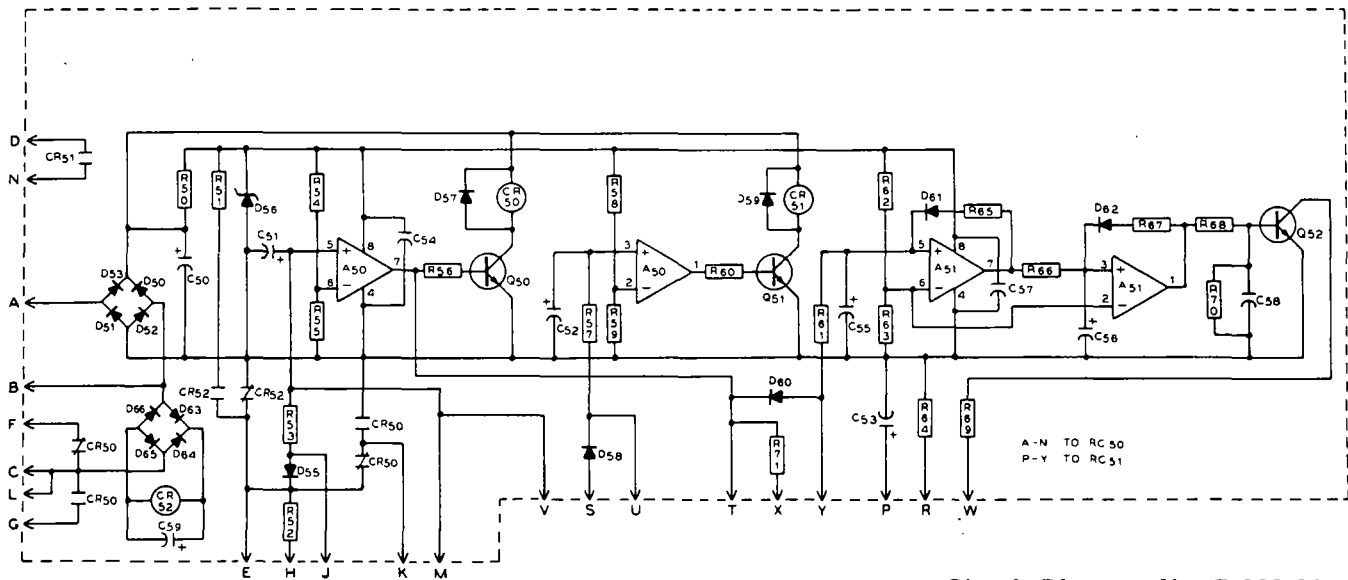
Circuit Diagram No. B-119 008

Figure 6 - 4. Circuit Diagram For Welding Power Source



Circuit Diagram No. A-090 568-A

Figure 6 - 5. Circuit Diagram For SPW-1 Panel



Circuit Diagram No. B-092 817-A

Figure 6 - 6. Circuit Diagram For SPW-1 Panel Printed Circuit Board PC50

SECTION 7 - WELDING TECHNIQUES & TROUBLESHOOTING

CAUTION: WELDING CURRENT can damage vehicle computers and other electronic components.

- Disconnect both battery cables before welding on a vehicle.
- Place work clamp as close to the weld as possible to avoid long electrical paths.
- Be sure gun to power source as well as cable connections to work clamp are clean and tight.
- To be 100 percent free of risk, disconnect the computer(s) from the vehicle.

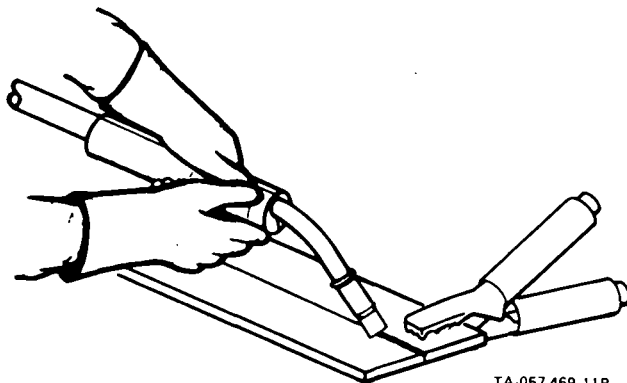
7 - 1. GAS METAL ARC WELDING (GMAW) - CONTINUOUS SEAM



Figure 7 - 1. Continuous Seam

The ability to produce a good bead while using the Continuous Seam Gas Metal Arc process is dependent on several factors. One of the most important, after wire and shielding gas selection, is the way the gun is held. Cradle the gun in one hand and rest the side of the hand on the workpiece (avoid doing this on hot material); use other hand to hold gun and control the gun trigger. Position the gun either toward or away from the body at a 45 to 60 degree lead angle (see Figure 7-2). This will give a good view of the arc and make it easier to follow the seam while wearing a helmet. Maintain a 1/4 to 5/16 inch (6-8 mm) distance from the bottom of the gun nozzle to the workpiece during the arc starting and welding period. Do not pull the gun back from the seam when the arc starts, as this will create a long wire extension and result in a poor weld.

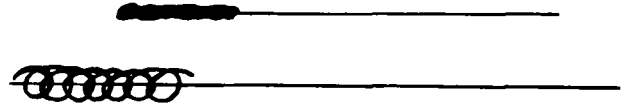
The welding wire is not energized until the trigger is pressed. Therefore the welding wire can be extended 1/4 inch (6 mm) beyond the gun nozzle and placed on the seam before lowering the helmet and pressing the gun trigger.



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Figure 7 - 2. Gun Position

The gun can be moved along the seam in a steady movement known as the drag technique (see Figure 7-3), or it can be oscillated a few degrees beyond each side of the seam. The travel speed will be regulated by the type of weld bead required, the thickness of the material, welding current selected and the technique used. However, the average speed is 15 to 20 inches per minute (0.4-0.5 mpm).



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Figure 7 - 3. Welding Techniques

Other welding techniques that affect the weld characteristics in the GMAW welding process include the backhand and forehand technique, and the vertical up and vertical down positions. In the backhand technique the gun is positioned so that the electrode wire is feeding in the opposite direction of arc travel. The filler metal is being fed into the weld metal previously deposited. In the forehand technique the gun is angled so that the electrode wire is fed in the same direction as the arc travel. The backhand technique generally yields a more stable arc and less spatter on the workpiece.



Direction of Arc Travel →

Backhand Technique



← Direction of Arc Travel

Forehand Technique

Figure 7 - 4. Longitudinal Gun Positions

The vertical up and/or vertical down techniques describe the direction of arc travel when the welding must be done in the vertical position. In both of these techniques gun positioning is extremely important because the arc must be kept on the leading edge of the puddle to ensure complete weld penetration. The drag technique is generally employed when welding in the vertical position, but when bridging a gap, the arc can be oscillated from one side of the work to the other.



Vertical Up



Vertical Down

Figure 7 - 5. Welding In The Vertical Up And Vertical Down Position

7 - 2. GAS METAL ARC WELDING (GMAW) - PULSED



Figure 7 - 6. Pulsed Seam

In pulsed welding the filler metal is transferred to the work during the period of Pulse On Time, and cools during the period of Pulse Off Time. When the selector switch is placed in the PULSE position and the gun trigger is depressed, the welding wire feeds through the gun for the length of time set on the SPOT TIME/PULSE ON TIME control. At the end of the pulse on time the welding wire stops feeding for the length of time set on the PULSE OFF TIME control. This on and off sequence continues for the amount of time selected on the time control until the gun trigger is released. The pulse option provides better control of the heat input to the weld on thin gauge metals, thereby decreasing distortion and the likelihood of burn throughs.

Set-up procedures for pulsed seam welding are the same as those for continuous seam welding except that the SELECTOR SWITCH is placed in the PULSE position and the SPOT TIME/PULSE ON TIME control and PULSE OFF TIME controls must be set to the desired positions.

7 - 3. GAS METAL ARC WELDING (GMAW) - SPOT



Figure 7 - 7. Spot Weld

Instead of having a continuous or pulsed weld to join two pieces of sheet steel together, welding in spot of 1 to 1 1/2 inches (25-38 mm) apart can be done. The MIG spot welding process fuses two pieces of sheet steel together by penetrating entirely through one of the pieces into the other. The spot process is designed to be used in any position. Little joint preparation is required other than cleaning the surfaces and ensuring that the two pieces overlap.

Spot welding is based on the same principles as continuous seam welding except that there is no travel speed involved; instead, there is a welding time interval. The weld is made by placing the welding gun directly on the top sheet and holding it motionless as shown in Figure 7-8. When the gun trigger is depressed, the electrode wire and shielding gas will be continuously fed. The arc will be maintained for the full length of time set on the SPOT TIME/PULSE ON TIME control and it will continue to penetrate in one place until the top sheet is welded with the bottom sheet. After the preset welding time has elapsed the wire will stop feeding, the contactor will open and the arc will be broken.

The GMAW spot welding process produces little heat, therefore little distortion results. Because of the low heat characteristics of this technique, it is often used when welds are made in close proximity to upholstery, rubber, or other flammable materials.

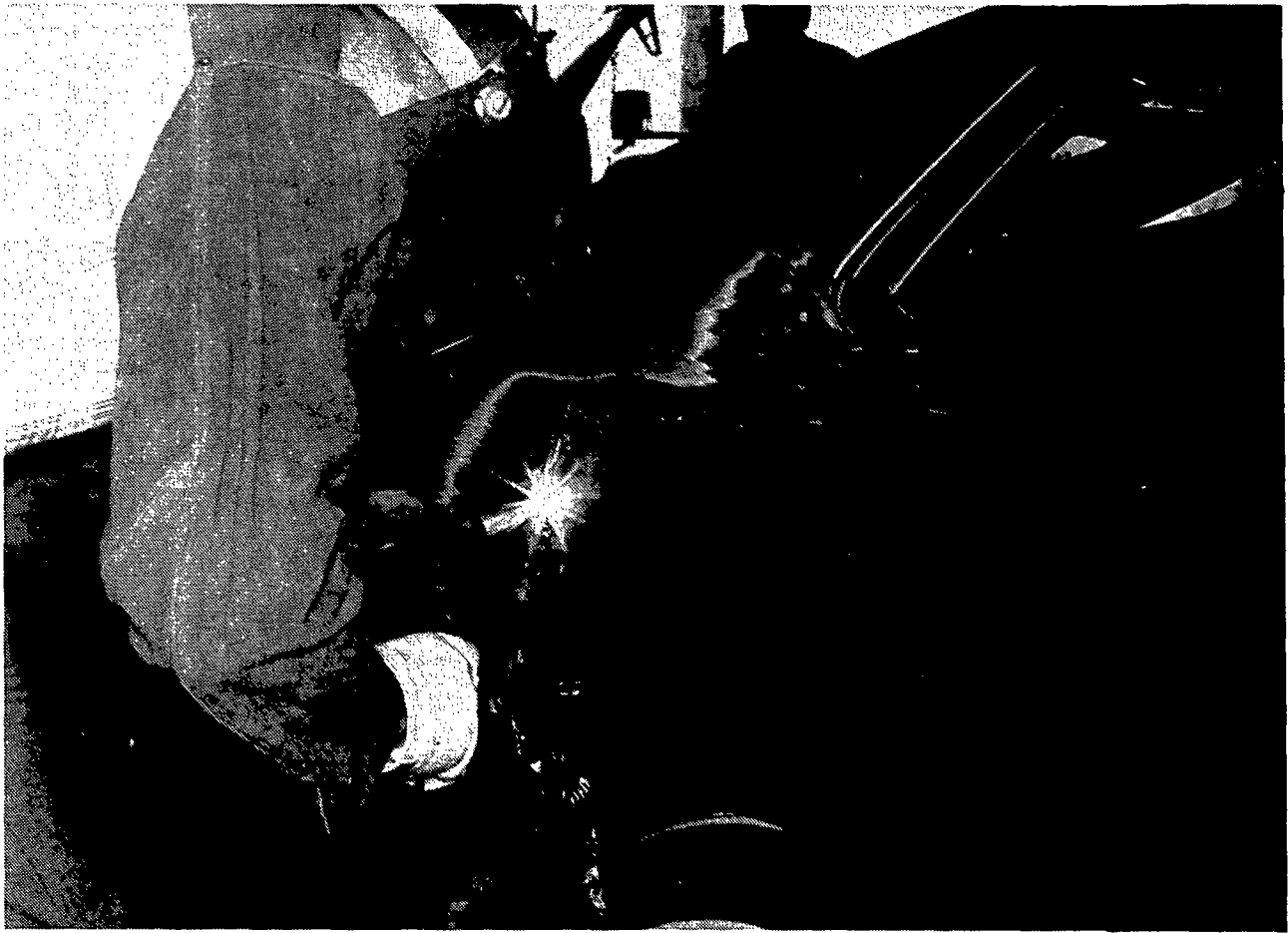


Figure 7 - 8. Fender Repair With Spot Nozzle

7 - 4. PLUG WELDS - Plug welds provide a means of joining two pieces of metal where the thickness of the top sheet is beyond the normal range of the welding power source or where sheet metal sections are too thin to be spot welded or pulsed welded without producing distortion or burn throughs. The plug weld is made by drilling or punching a hole in the top sheet, clamping the metal sections tightly together, and filling the hole with a weldment. The plug weld can be timed using the spot timer or untimed. Plug welds should be spaced 1 to 1 1/2 inches (25-38 mm) apart.

Plug welds on sample materials should be made so that proper parameters can be set.

7 - 5. SKIP WELDING - Skip welding provides a means of making a series of short welds, usually less than 3/4 in. (18 mm) in length each, consistent in size and appearance. Skip welding can be accomplished with this unit by setting a spot weld time and jogging the gun trigger off and on again each time the spot timer times out.

Skip welds on sample material should be made so that proper parameters can be set.

7 - 6. TROUBLESHOOTING THE GAS METAL ARC WELDING PROCESS

A. Porosity



Figure 7 - 9. Porosity

Possible Causes	Corrective Actions
1. Inadequate shielding gas coverage.	Remove spatter from the gun nozzle.
	Check gas hoses for leaks.
	Eliminate drafts (from fans open doors, etc.) blowing into the welding arc.
	Reduce nozzle-to-work distance.
	Increase gas flow to displace all air from the weld zone.
	Decrease excessive gas flow to avoid turbulence and the entrapment of air in the weld zone.
	Hold gun at end of weld until molten metal solidifies.
	Check for frozen CO ₂ regulator flow meter.
2. Gas contamination.	Use welding grade shielding gas.
3. Electrode contamination.	Use only clean and dry electrode.
	Eliminate pick up of oil or lubricant on electrode in electrode feeder or conduit.
4. Workpiece contamination.	Remove all grease, oil, moisture, rust, paint, undercoating, and dirt from work surface before welding.
	Use a more highly deoxidizing electrode wire.
5. Excess tip-to-work distance.	Reduce stick-out.

B. Incomplete Fusion (Lack of fusion)

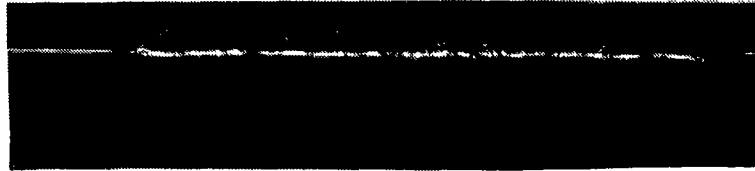


Figure 7 - 10. Incomplete Fusion

Possible Causes	Corrective Actions
1. Weld zone surfaces not free of film or excessive oxide.	Clean weld zone surfaces of impurities prior to welding.
2. Insufficient heat input.	Select higher voltage tap.
3. Improper weld technique.	When using a weaving technique dwell momentarily on the side walls of the groove.
	Provide improved access at root of joints.
	Keep electrode directed at the leading edge of the puddle.
	Provide proper gun angle.
4. Improper joint design (Heavy material only: trailer hitches, etc.)	Provide included angle of groove joint large enough to allow access to bottom of the groove and sidewalls with proper electrode extension and arc characteristics, or use a "J" or "U" groove.

C. Lack Of Fusion

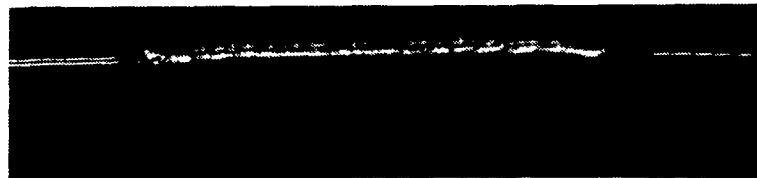


Figure 7 - 11. Lack Of Penetration

Possible Causes	Corrective Action
1. Improper joint preparation.	Material too thick. Joint preparation and design must be adequate to provide access to the bottom of the groove while maintaining proper electrode extension and arc characteristics.
	Reduce excessively large root face.
	Provide or increase the root gap in butt joints and increase the depth of back gauge.
2. Improper weld technique.	Maintain electrode angle normal to work surface to achieve maximum penetration.
	Keep arc on leading edge of the puddle.
3. Inadequate heat input.	Select higher voltage tap and wire speed.
	Reduce the travel speed.
	Maintain proper electrode extension.

D. Excessive Penetration (Burn-Through)



Figure 7 - 12. Excessive Penetration

Possible Causes	Corrective Actions
1. Excessive heat input.	Select lower voltage tap and reduce wire speed.
	Increase travel speed.

E. Cracks In Weld Metal

Possible Causes	Corrective Actions
1. Improper joint design (Heavy material).	Maintain proper groove dimensions to allow deposition of adequate filler metal to weld area.
2. Heat input too high causing excessive shrinkage and distortion.	Select lower voltage tap and reduce wire speed.
	Increase travel speed.

F. Waviness of Bead



Figure 7 - 13. Waviness Of Bead

Possible Causes	Corrective Actions
1. Excessive electrode extension.	Reduce electrode extension.
2. Unsteady hand.	Support hand on solid surface.

G. Humping

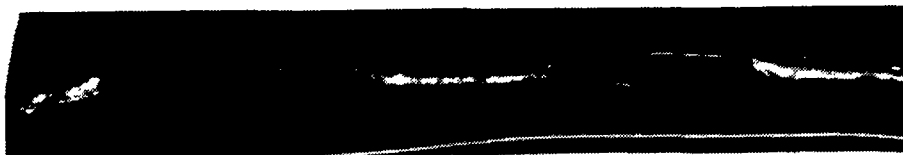


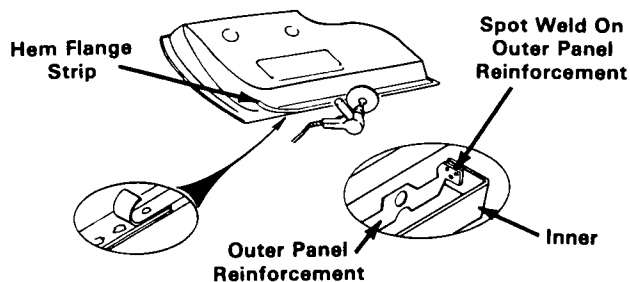
Figure 7 - 14. Humping

Possible Causes	Corrective Actions
1. Too much heat input.	Select lower voltage tap or increase travel speed.
	Weld in small segments and allow to cool between welds.

H. Excessive Spatter

Possible Causes	Corrective Actions
1.Excessive spatter when using CO ₂ shielding gas.	Select lower voltage tap or adjust WIRE SPEED ADJUSTMENT.

3. If door has an outer panel reinforcement, break the weld.
4. Grind off the hem flange and remove the old panel.
5. Repair any damage to the inner panel.
6. Position new outer panel over door and bend the end flange over the inner flange.
7. Spot weld outer panel reinforcement to new door panel.
8. Spot weld new hem flange to inner panel.
9. Metal finish exterior surface, paint and assembly interior trim and hardware.



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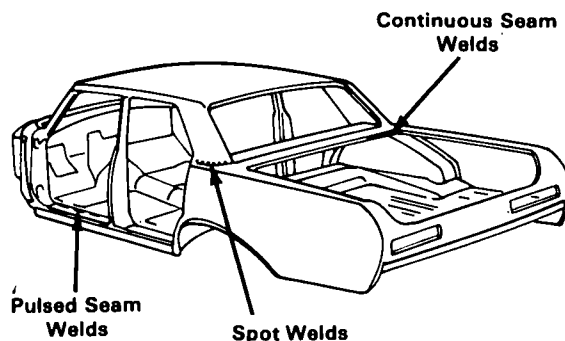
Figure 8 - 2. Hem Flange Removal

8 - 4. HOW TO PREVENT GLASS BREAKAGE AND SPATTER ON WINDOWS - Spatter and excessive heat can become problems when welding near windows. Protect the windows by keeping them covered and as far away from the heat zone as possible. When welding must be performed near windows, the windows should be covered and protected from excessive heat by using wet rags. A putty like substance which reduces heat transfer is available through your welding supplier. If burn through and spatter become problems, ensure that the correct voltage tap is being used for the size material being welded. Use an argon and CO₂ gas mixture and check travel speed.

8 - 5. PROCEDURES FOR WELDING FENDERS AND QUARTER PANELS - When a complete panel must be replaced it will be necessary to remove the bolts securing the panel to the rest of the structure, or to cut through the spot welds if the panel is welded in place. In most cases a front fender will be bolted in place, while the other panels will be either spot welded or continuous seam welded. The alignment of front fenders is usually simple because the bolt holes are often elongated so that the position of the new front fender can be shifted and correctly aligned. Generally all other panels are welded into place.

If the whole panel is to be replaced, the old panel must be removed by cutting along the weld if welded by continuous seam, or by drilling out the spot welds if it is

spot welded in place. Car and body manufacturers have the panels welded in different places, so it will be necessary to inspect the body to determine where the welds are located in each case. After the old panel is removed, the inner panels must be carefully checked, straightened or replaced.



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Figure 8 - 3. Automotive Body Sections Assembled With Continuous Seam, Pulsed, And Spot Welds

The new outer panel can then be placed and held in position by vice-grips or c-clamp. When welding, start at the center and proceed first in one direction and then the other. In order to ensure reduced distortion due to heat, weld only a section of 2 or 3 in. (51-76 mm) at a time. It is important to constantly check the over all temperature of the sheet steel around the welding area, because it is in this concentrated heat area that warpage and distortion will begin. Leave a gap and then weld another short section. When the weld is completed it can be hammered down, filled with body putty and sanded.

8 - 6. WELDING FRAMES AND HIGH STRENGTH (HSS) STEELS - The new HSS steels are used on many of the new economy compact cars. HSS steels can be found in the steel gussets, brackets, floor pans and support members of these new models. HSS steels are thinner for weight reduction and are heat sensitive. As heat is applied, the strength decreases and cracking can occur, therefore the heat affected zone must be kept as small as possible. For this reason the GMAW welding process has become the preferred method for welding HSS steels, and the oxacetylene welding or brazing processes, with its wider heat affective area, are normally not recommended.



Figure 8 - 4. Application Of Body Putty

SECTION 8 - AUTO BODY REPAIR APPLICATION

CAUTION: WELDING CURRENT can damage vehicle computers and other electronic components.

- Disconnect both battery cables before welding on a vehicle.
- Place work clamp as close to the weld as possible to avoid long electrical paths.
- Be sure gun to power source as well as cable connections to work clamp are clean and tight.
- To be 100 percent free of risk, disconnect the computer(s) from the vehicle.

8 - 1. POINTERS FOR WELDING AUTO BODY SHEET METAL

- Before using this equipment to weld on a finished piece of work, make a few practice welds on a sample piece of material the same as that of the finished workpiece. Whenever possible, weld in the flat position since this is the easiest position to learn. Be sure that the material to be welded is clean and free of paint and rust. The work cable clamp must be attached to the parts being welded. Clean surface to ensure proper grounding and to complete the current path.

Use a .023 in. (0.6 mm) E70S-6 wire and argon/carbon dioxide shielding gas.

Use direct current straight polarity for reduced burn through. Open left side access door, and visually check position of polarity changeover jumper links on polarity changeover board on center baffle of unit. If necessary, reposition jumper links according to Section 3-3.

IMPORTANT: For maximum penetration on thicker materials such as 18 gauge (1.22 mm) and thicker, reconnect for direct current reverse polarity (work lead to negative, electrode wire to positive).

8 - 2. PROCEDURE FOR WELDING MILD STEELS

- The following are some basic guidelines that can be used when using this welding power source to weld mild or high strength steels:

1. Use a power wire brush or sander to remove paint to bare metal in the area to be repaired. Two to three inches (51-76 mm) on either side of the weld area should be cleaned for applying body filler after welding is completed.
2. Remove damaged metal using hand cutters, shears, or a power hand grinder equipped with a cutting wheel.
3. Fit a new piece of sheet steel over the section which was removed. The new material should overlap the cut away section by one inch (25 mm).
4. Clamp the new metal in place, and prepare to spot weld.
5. Place the VOLTAGE ADJUSTMENT switch in the 3 position.
6. Install the spot nozzle on the gun.

7. With the shielding gas and power source turned on, place the spot nozzle and press firmly against the new material about 1/2 to 3/4 in. (12-18 mm), from the edge. Fit up must be tight to assure good, repeatable spot welds.
8. Begin spot welding from the center out on each side. Distortion may occur if welding begins at the corners.
9. Space spot welds 1 to 1 1/2 in. (25-38 mm), apart around the repair. Spot welds should be about 3/16 in. (5 mm) in diameter.

IMPORTANT: Do not make continuous welds around the repair as this will promote distortion and warpage.

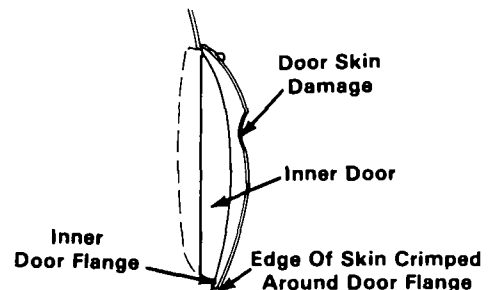
10. After welding, remove the clamp and grind spot flush to surface.
11. Smooth the joints with body filler and finish.

8 - 3. PROCEDURES FOR WELDING DOOR PANELS

IMPORTANT: Every experienced autobody repairman will have his own method of performing the following procedures. However, this information is presented to show how, in most cases, this welding power source can make the job easier and less time consuming.

If the door is severely damaged, but the damage is primarily in the outer panel, or "skin", the door can be easily repaired without necessarily installing a whole new door.

1. Remove exterior molding and hardware. It is not necessary to remove window regulator, remote control mechanisms, lock or runs.
2. Remove door assembly, and place on flat surface with edges of door extending over edges of surface to provide room to work.



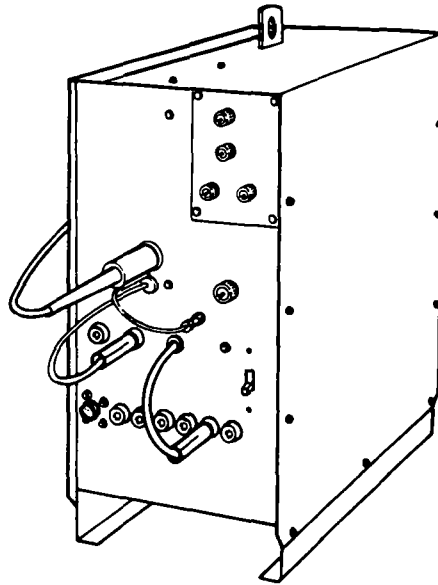
TA-087 297

Figure 8 - 1. Cutaway Of Door Panel Damage

May 1988

FORM: 113 336A

Effective With Serial No. JJ377166



PARTS LIST

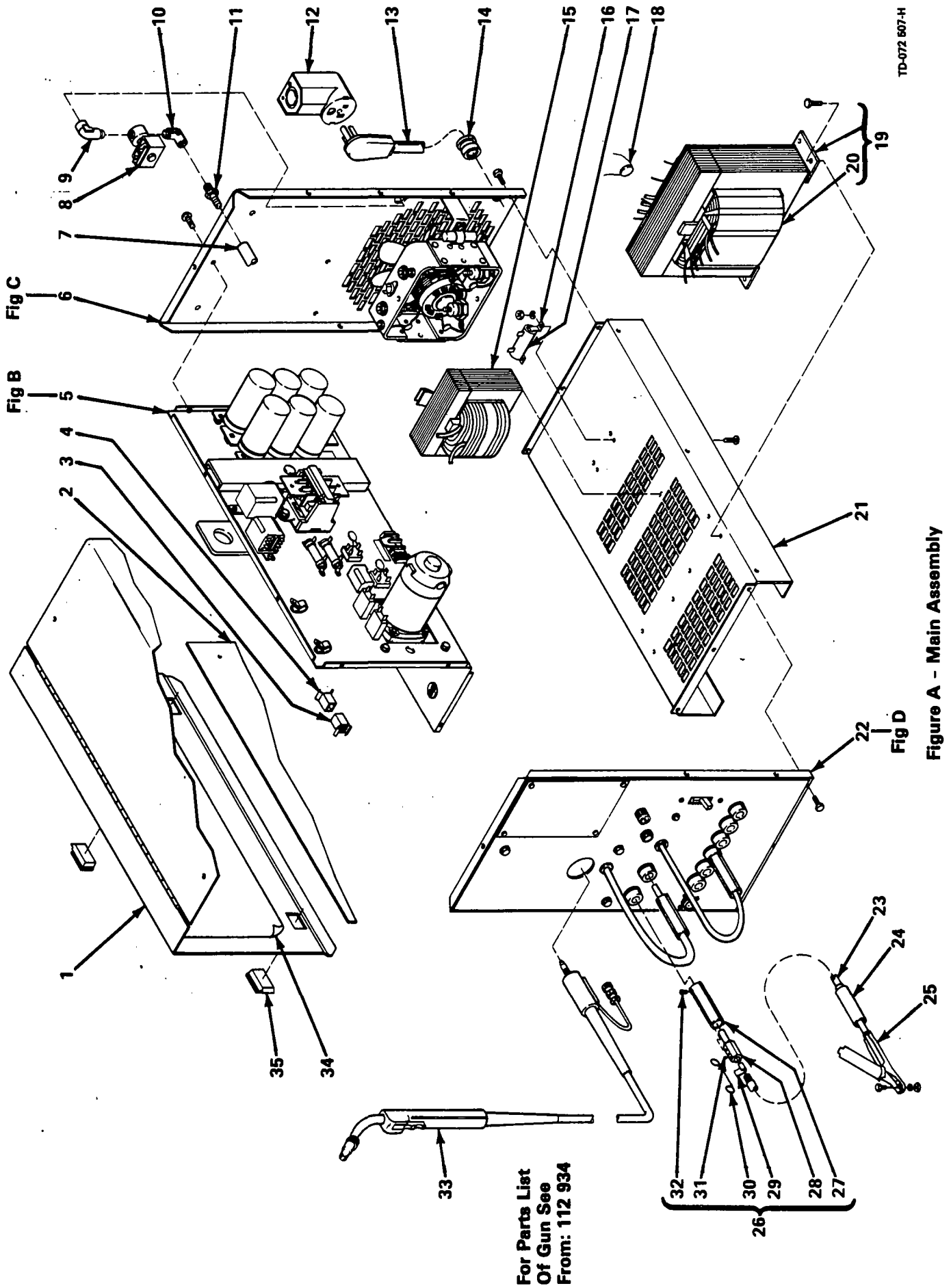


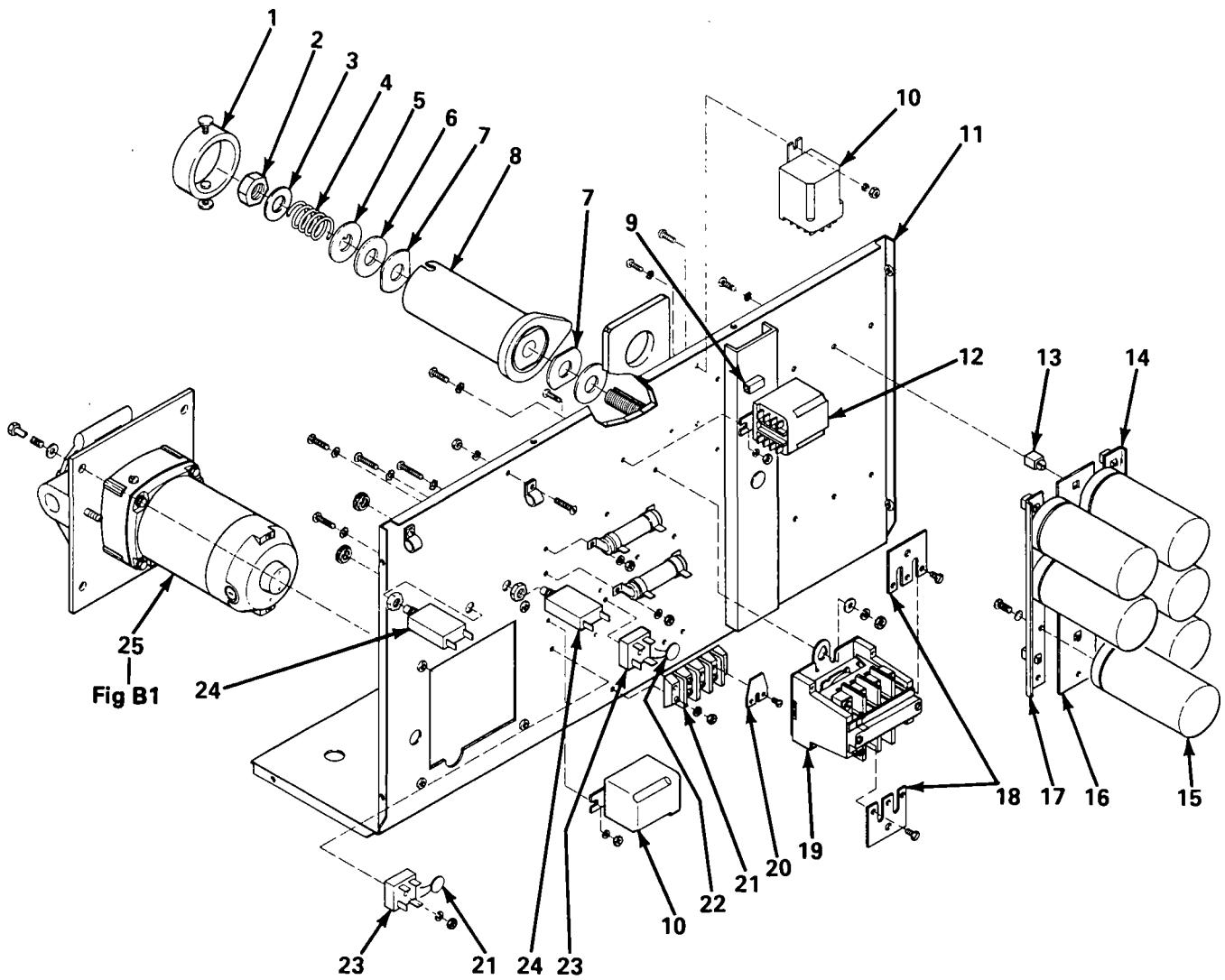
Figure A - Main Assembly

Replace Coils at Factory or Factory Authorized Service Station

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
Figure A Main Assembly				
1		115 521	WRAPPER	1
2		115 522	PANEL, side	1
3		008 040	CONNECTOR, jumper	1
4	PLG2	008 073	HOUSING RECEPTACLE & SOCKETS(consisting of)	1
		058 972	. TERMINAL, female	8
5		Figure B	BAFFLE, air-w/components (Pg 4)	1
6		Figure C	PANEL, rear-w/components (Pg 6)	1
7		604 550	HOSE, No. 1 x 3/16 ID (order by ft)	3 ft
		089 120	CLAMP, hose 3/16	1
8	GS1	035 630	VALVE, 24 volts ac/6 volts dc 2 way 1/4 IPS port 1/8 orifice	1
9		010 296	FITTING, hose-elbow M 1/4 NPT x 5/8-18 RH	1
10		010 678	FITTING, pipe-elbow street 1/4 NPT LH	1
11		073 433	FITTING, barbed male 3/16 TBG x 1/4 NPT	1
12		039 778	RECEPTACLE, straight 3 pole 50 amp 250 volts	1
13	PLG1	023 210	CABLE, power 10/3 9 ft 50 amp cap	1
14		010 290	BUSHING, strain relief 1.09 x 1.03 hole	1
15	Z	083 912	STABILIZER	1
16		605 741	CLIP, mtg-resistor	2
17	R2	079 781	RESISTOR, WW fixed 25 watt 50 ohm	1
18	TP2	092 239	THERMOSTAT, NO	1
19	T1	093 173	TRANSFORMER, power-main (208/230) (consisting of)	1
20		092 028	. COIL, pri/sec	1
21		083 175	SKID, base	2
22		Figure D	PANEL, front-w/components (Pg 8)	1
23		023 100	CABLE, interconnecting-ground	1
24		026 843	INSULATOR, vinyl	2
25		010 368	CLAMP, ground 100 amp	1
26		039 901	PLUG, jack-black (consisting of)	1
27		026 978	. INSULATOR, jack plug-black	1
28		101 219	. PLUG, jack	1
29		019 833	. STRIP, copper	1
30		010 521	. WIRE, tie	1
31		602 178	. SCREW, set 1/4-20 x 3/8	2
32		602 160	. SCREW, self-tapping 8-32 x 1/4	1
33		++	GUN	1
34		113 227	LABEL, instructions	1
35		089 899	LATCH, slide flush style	2
			Running Gear (Fig F Pg 11)	1
		113 280	HOSE, air (consisting of)	1
		089 120	. CLAMP, hose 3/8 - .450 dia	2
		113 129	. TUBING, 1/4 ID x 1/16 (order by ft)	4ft
		112 863	. FITTING, adapter	1
		112 811	LABEL, Auto Arc emblem (rear panel)	1
		113 603	LABEL, Auto Arc MW-4150 (top of front panel)	1
		113 605	LABEL, Auto Arc MW-4150 (left side panel)	1
		113 606	LABEL, Auto Arc MW-4150 (right side panel)	1

++ For Parts List of Gun See FORM: 112 934

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.



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Figure B - Baffle, Air - W/Components

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
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Figure B

Baffle, Air - W/Components (Fig A Pg 2 Item 5)

1		058 427	RING, retaining-spool	1
2		085 980	NUT, hex-full 5/8-11	1
3		605 941	WASHER, flat-41/64 ID x 1 OD x 14 ga.....	1
4		057 543	SPRING, compression	1
		057 745	SPRING, compression 2.215 OD x 2-1/2 (used with 8" spool).....	1
5		057 971	WASHER, flat-keyed 1-1/2 dia	1
6		010 191	WASHER, fiber 5/8 ID x 1-1/2 OD x 1/8.....	2
7		058 628	WASHER, steel-brake	2
8		058 428	HUB, spool	1
9		026 837	INSULATOR, terminal-nylon	1
10	CR2,3	006 393	RELAY, enclosed 24 volts ac DPDT flanged	2
11	CR1	072 817	RELAY, enclosed 24 volts ac DPDT flanged	1
12		044 995	BAFFLE, air	1
13		083 147	GROMMET, push in	6
14		082 907	ANGLE, mtg-RH capacitor	1
15	C6	031 728	CAPACITOR, electrolytic 20,000 uf 35 volts dc	6
16		082 902	STRIP, mtg-center capacitor	1
17		082 875	ANGLE, mtg-LH capacitor	1
18		034 260	LINK, connector-contactors	2
19	W	035 519	CONTACTOR, 40 amp 3 pole 24 volts (consisting of)	1
		024 493	. COIL, 24 volts	1
20		038 620	LINK, jumper	1
21	TE1	026 189	BLOCK, terminal 30 amp 3 pole	1
22	VR1,2	082 722	VARISTOR, 0.6 watt 175 volts dc	2
23	SR2,3	035 914	RECTIFIER, integrated 25 amp 400 volts	2
24	CB1,2	083 431	CIRCUIT BREAKER, manually reset 5 amp 250 volts	2
25		120 663	DRIVE ASSEMBLY, wire (Fig B1 Pg 5)	1
26		605 741	CLIP, mtg-resistor	2
27	R3	059 642	RESISTOR, WW fixed 25 watt 10 ohm	1
28		010 014	CLAMP, 3/4 x 13/64 hole	2
29	R5	006 537	RESISTOR, WW fixed 12 watt 0.5 ohm.....	1
30		052 704	CLIP, mtg-resistor	2

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
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Figure B1 120 663 Drive Assembly, Wire (Fig B Pg 4 Item 25)

1		605 854	RING, retainer	2
2		072 649	BEARING, flanged	1
3		112 909	GEAR, drive .030-.035 wire	1
4		605 287	KEY, 1/16 x 1/4	2
5		058 360	SHAFT	1
6		058 363	COVER	1
7		072 585	BEARING, flanged 5/16 x 7/16 x 3/8	1
8		010 918	PIN, spring 5/32 x 1-1/2	1
9		057 551	SPRING, pressure	1
10		056 081	LINER, monocoil	1
11		605 525	NUT, self-locking hex 5/16-24	1
12		112 907	GEAR, drive .024	1
13		010 929	WASHER, flat-spring 3/8	1
14	M	093 153	MOTOR, gear(consisting of)	1
15		*031 595	BRUSH, w/spring	2
16		057 432	SCREW, brush holder cap	2
17		079 624	SCREW, cap-hex hd 3/8-16 x 2-1/4	1
18		602 213	WASHER, lock-split 3/8	2
19		010 910	WASHER, flat-SAE 3/8	1
20		044 994	INSULATOR, motor	1
21		601 838	NUT, brass-hex jam 3/8-16	1
22		079 633	FITTING, hose-barbed nipple 3/16 TBG	1
23		044 954	HOUSING, drive-roll feeder	1
24		079 772	KNOB	1
25		058 359	PIN, pivot	1
26		604 741	PIN, cotter-hair 0.042 x 15/16	1

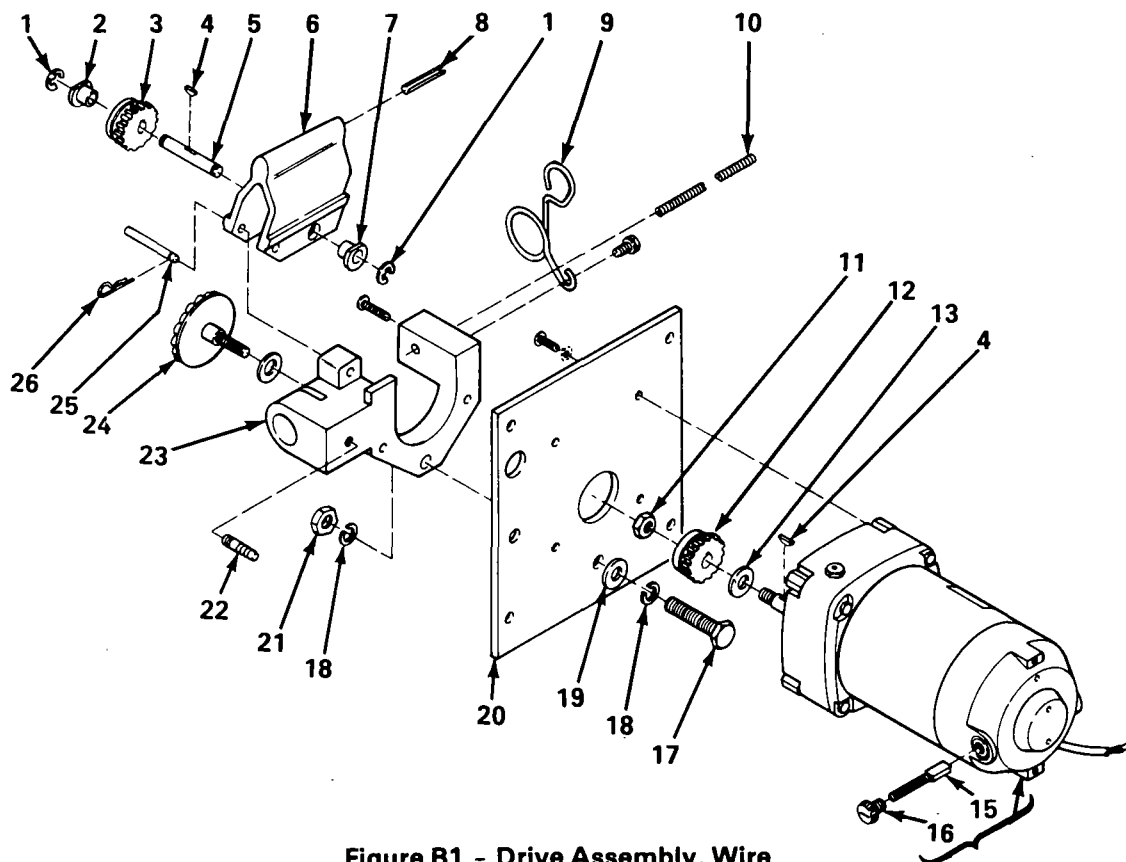


Figure B1 - Drive Assembly, Wire

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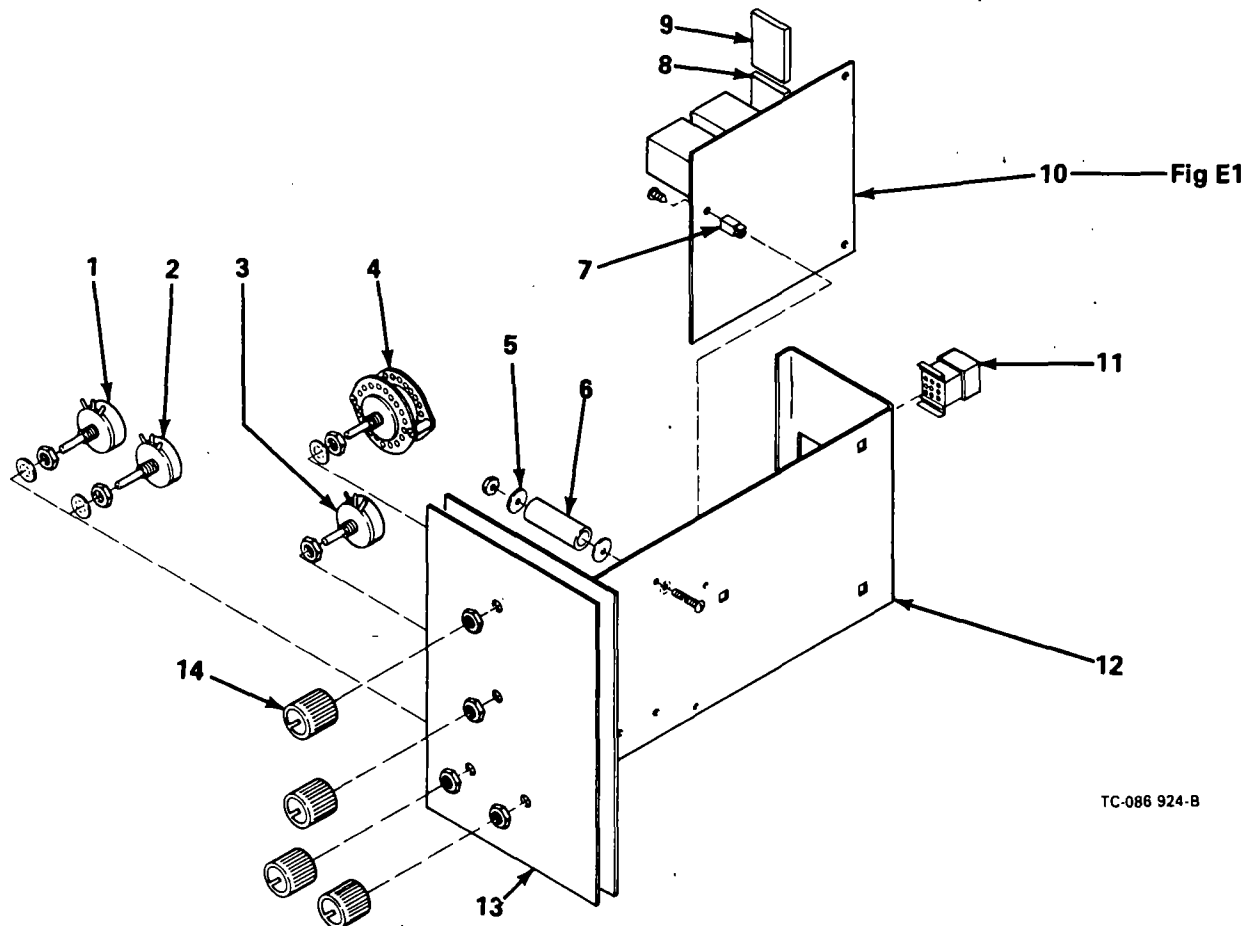
*Recommended Spare Parts.

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
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Figure E **SPW 1 Spot Panel**

1	R50	028 769	POTENTIOMETER, carbon 1 turn 2 watt 750K ohm	1
2	R51	028 770	POTENTIOMETER, carbon 1 turn 2 watt 1 meg ohm	1
3	R52	028 768	POTENTIOMETER, carbon 1 turn 2 watt 350K ohm	1
2	R51	028 770	POTENTIOMETER, carbon 1 turn 2 watt 1 meg ohm	1
3	R52	028 768	POTENTIOMETER, carbon 1 turn 2 watt 350K ohm	1
4	S50	086 895	SWITCH, rotary 3 position	1
5		073 914	WASHER, centering 7/16 dia	2
6	R53	605 890	RESISTOR, WW fixed 15 watt 0.25 ohm	1
7		080 509	GROMMET, SCR No. 8/10	3
8	PLG51	072 669	HOUSING, terminal 9 position	1
9	PLG50	079 798	HOUSING, terminal 13 position	1
10	PC50	097 897	CIRCUIT CARD (Fig E1 Pg 10)	1
11	RC55	008 072	HOUSING PLUG & PINS (consisting of)	1
		058 971	. TERMINAL, male	8
12		086 650	PANEL	1
13		113 471	NAMEPLATE (order by model & serial number)	1
14		097 922	KNOB, pointer	4
		112 770	NOZZLE, spot-outside corner	1
		112 772	NOZZLE, spot-inside corner	1
		112 768	NOZZLE, spot-flat	1



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Figure E - SPW 1 Spot Panel (Optional)

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
Figure D Panel, Front - W/Components (Fig A Pg 2 Item 22)				
1		039 801	RECEPTACLE ASSEMBLY, jack-black(consisting of)	1
2		091 542	. RECEPTACLE & NUT	1
3		010 291	. WASHER, flat-nylafil 5/8 ID x 1-1/4 OD x 1/8	1
4		604 668	. NUT, self-locking hex 1/2-20	1
5		605 787	. WASHER, lock-internal tooth 1/2	1
6		601 881	. NUT, hex-jam 1/2-20	1
7		+ 119 543	NAMEPLATE(order by model & serial number)	1
		113 604	LABEL, warning	1
8		119 191	PANEL, front	1
9		087 274	COVER, open-module	1
10	RC3	073 383	RECEPTACLE, 3 socket MS-3102A-14S-1S	1
11		039 800	RECEPTACLE ASSEMBLY, jack-red(consisting of)	1
12		010 291	. WASHER, flat-nylafil 5/8 ID x 1-1/4 OD x 1/8	1
13		604 668	. NUT, self-locking hex 1/2-20	2
14		605 787	. WASHER, lock-internal tooth 1/2	1
15		601 881	. NUT, hex-jam 1/2-20	1
16		091 541	. RECEPTACLE & NUT	1
17	R1	605 828	RHEOSTAT, WW 50 watt 1.5 ohm	1
18	RC1	048 282	RECEPTACLE W/SOCKET (consisting of)	1
		079 534	. TERMINAL, female	4
19	S1	090 328	SWITCH, toggle 2PST 40 amp 600 volts ac	1
20		097 924	KNOB, pointer	1
21		057 608	RECEPTACLE ASSEMBLY, jack-yellow(consisting of)	6
22		601 881	. NUT, hex-jam 1/2-13	1
23		605 787	. WASHER, lock-internal tooth 1/2	1
24		604 668	. NUT, self-locking hex 1/2-20	2
25		010 291	. WASHER, flat-nylafil 5/8 ID x 1-1/4 OD x 1/8	1
26		072 334	. RECEPTACLE & NUT	1
27		023 084	CABLE & PLUG ASSEMBLY, jack (consisting of)	1
28		039 878	. PLUG ASSEMBLY, jack-yellow (consisting of)	1
29		602 160	.. SCREW, self-tapping 8-32 x 1/4	1
30		026 975	.. INSULATOR, jack plug-yellow	1
31		101 219	.. PLUG	1
32		602 178	.. SCREW, set 1/4-20 x 3/8	2
33		019 833	.. STRIP, copper	1
34		600 318	. CABLE, weld No. 3 (order by ft)	3ft
35	PL1	048 573	LIGHT, indicator-red lens 28 volts	1
36		010 325	BUSHING, strain-relief	2
37		044 943	CABLE & PLUG ASSEMBLY, jack (consisting of)	1
38		600 318	. CABLE, weld-No. 3 (order by ft)	2 ft
39		039 608	. PLUG ASSEMBLY, jack-red (consisting of)	1
40		019 833	.. STRIP, copper	1
41		602 178	.. SCREW, set 1/4-20 x 3/8	2
42		101 219	.. PLUG	1
43		602 814	.. INSULATOR, jack plug-red	1
44		602 160	.. SCREW, self-tapping 8-32 x 1/4	1

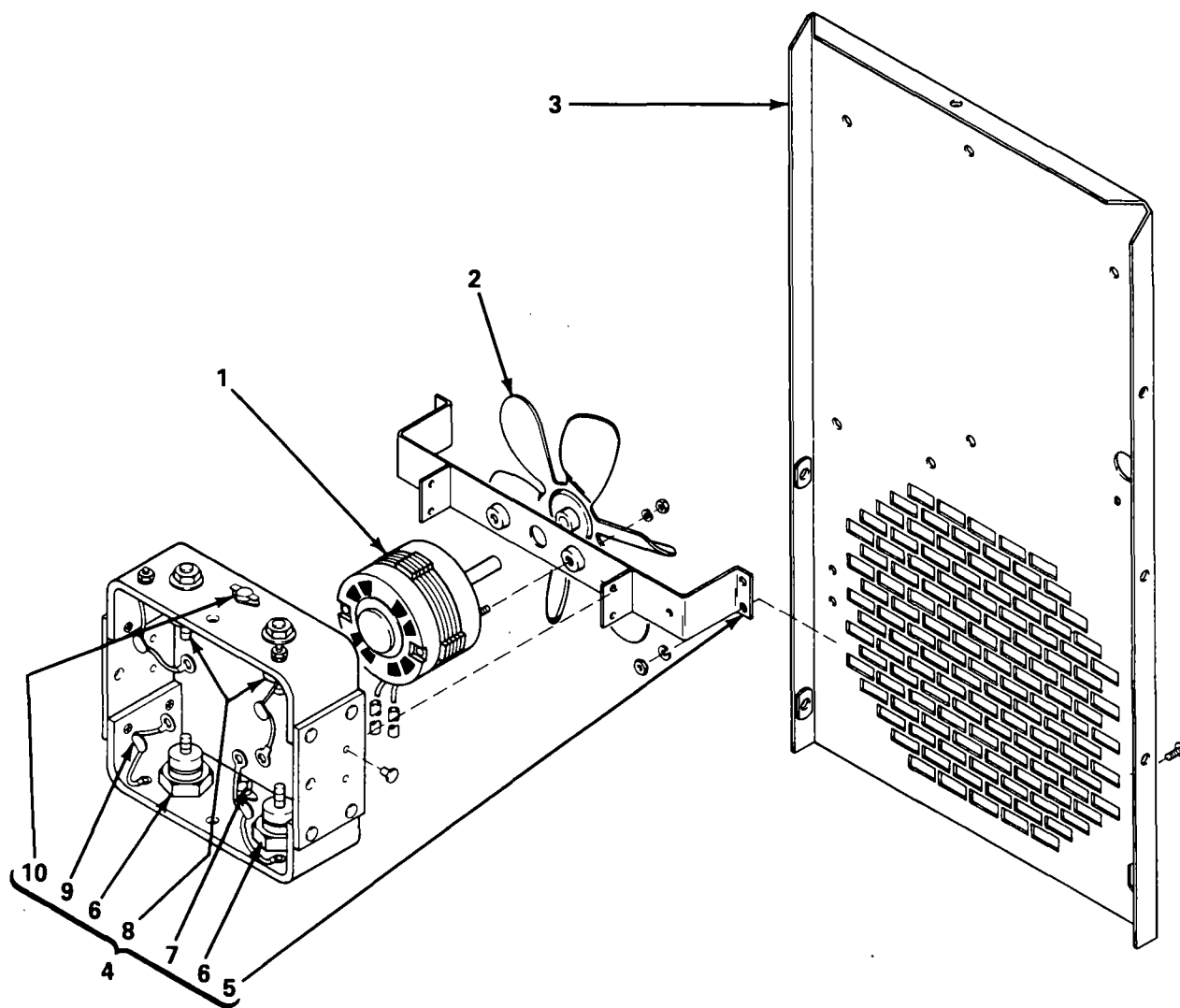
+ When ordering a component originally displaying a precautionary label, the label should also be ordered.
BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
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Figure C

Panel, Rear-W/Components (Fig A Pg 2 Item 6)

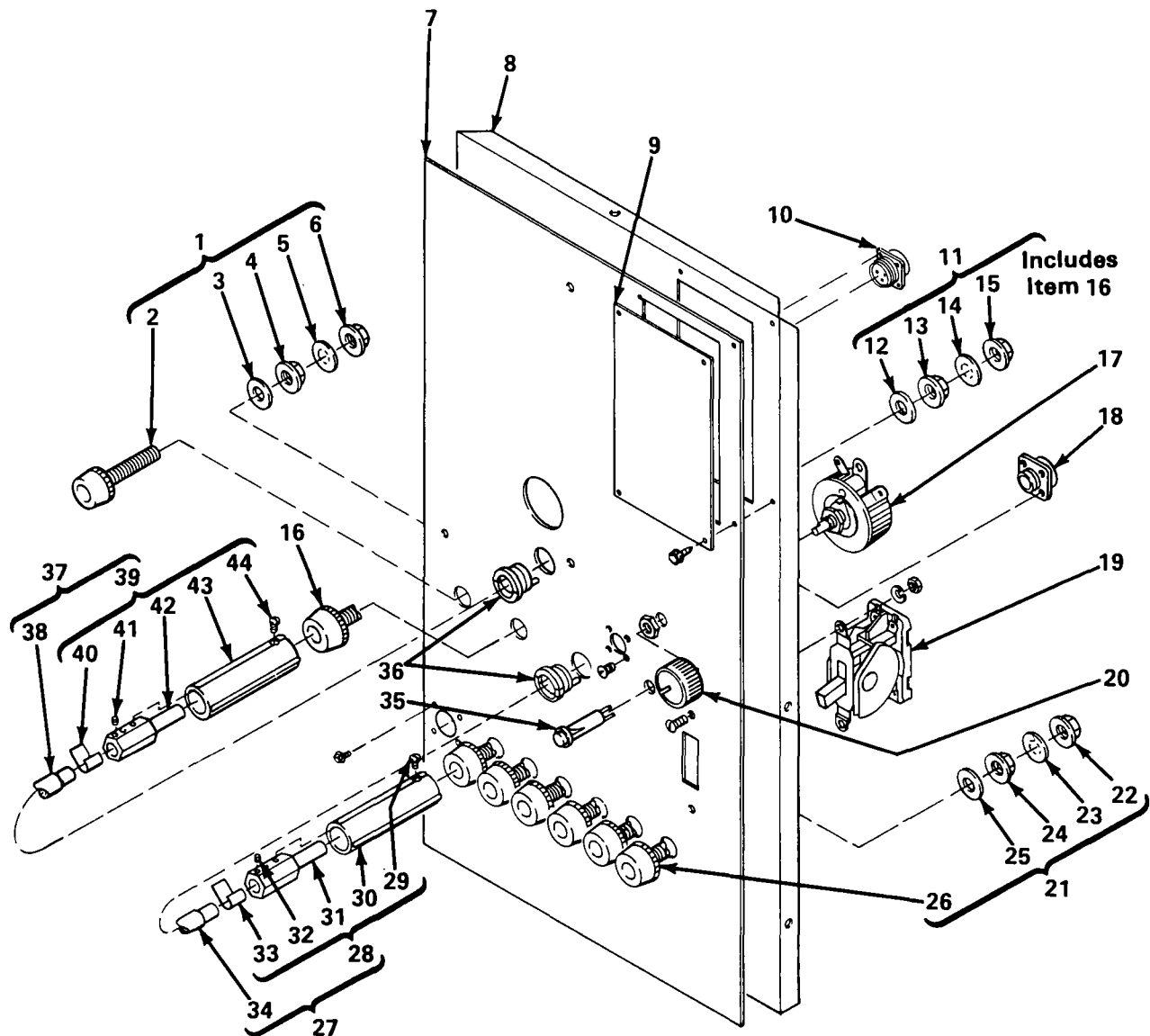
1	FM	032 678	MOTOR, fan 230 volts ac	1
2		032 662	BLADE, fan 60 Hz 10 inch 6 wing	1
3		083 916	PANEL, rear	1
4	SR1	089 733	RECTIFIER, silicon diode (consisting of)	1
5		057 496	. BRACKET, mtg-rectifier & fan motor	1
6		037 306	. DIODE, 150 amp 300 volts RP	2
7	TP3	086 323	. THERMOSTAT, NO	1
8		037 305	. DIODE, 150 amp 300 volts SP	2
9	C1-4	031 689	. CAPACITOR, ceramic 0.01 uf 500 volts dc	4
10	TP1	604 515	. THERMOSTAT, NC	1



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Figure C - Panel, Rear-W/Components

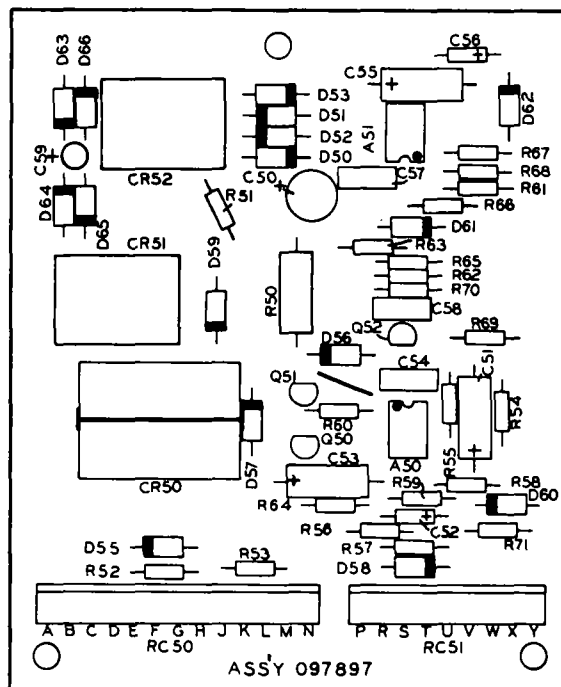
BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.



TB-072 510-E

Figure D - Panel, Front-W/Components

Dia. Mkgs.	Part No.	Description	Quantity
Figure E1	097 897	Circuit Card (Fig E Pg 9 Item 10)	
A50,51	009 159	1C, linear	2
C50	039 482	CAPACITOR, electrolyte 100 uf 35 volts dc	1
C51,53,55	032 820	CAPACITOR, tantalum 2.2 uf 35 volts dc	3
C52,56	073 714	CAPACITOR, tantalum 0.22 uf 35 volts	2
C54,57,58	073 739	CAPACITOR, ceramic 0.1 uf 50 volts dc	3
C59	090 573	CAPACITOR, electrolyte 10 uf 50 volts	1
CR50	027 810	RELAY, enclosed 24 volts dc 4PDT	1
CR51	099 019	RELAY, enclosed 24 volts dc SPDT	1
CR52	099 018	RELAY, enclosed 24 volts dc SPDT	1
	079 844	SPRING, holddown-relay	1
	091 861	SOCKET, relay	1
D50-54,57-66	026 202	DIODE, 1 amp 400 volts SP	15
D56	037 449	DIODE, zener 15 volts 1 watt SP	1
Q50,51	037 200	TRANSISTOR, 200MA 40 volts NPN	2
Q52	073 535	TRANSISTOR, 100MA 30 volts NPN	1
R50	030 018	RESISTOR, carbon 1 watt 820 ohm	1
R51	035 823	RESISTOR, carbon film 0.25 watt 100 ohm	1
R52,71	035 884	RESISTOR, carbon film 0.25 watt 100K ohm	2
R53,57,61,68,70	039 331	RESISTOR, carbon film 0.25 watt 4.7K ohm	5
R54,56,59,60,62,			
66,67	035 827	RESISTOR, carbon film 0.25 watt 10K ohm	7
R55,58	035 886	RESISTOR, carbon film 0.25 watt 22K ohm	2
R63	039 333	RESISTOR, carbon film 0.25 watt 18K ohm	1
R64,69	039 327	RESISTOR, carbon film 0.25 watt 220 ohm	2
R65	035 887	RESISTOR, carbon film 0.25 watt 220 ohm	1
	092 648	RESISTOR, carbon film 0.25 watt zero ohm	1
RC50	079 795	TERMINAL, head 13 pin	1
RC51	072 670	TERMINAL, header 9 pin	1
PLG50	+ 079 798	HOUSING, terminal header 13 pin	1



Ref: C-097 895

**COMPONENTS TO BE
REPLACED BY QUALIFIED
PERSONNEL ONLY**

Figure E1 - Circuit Card

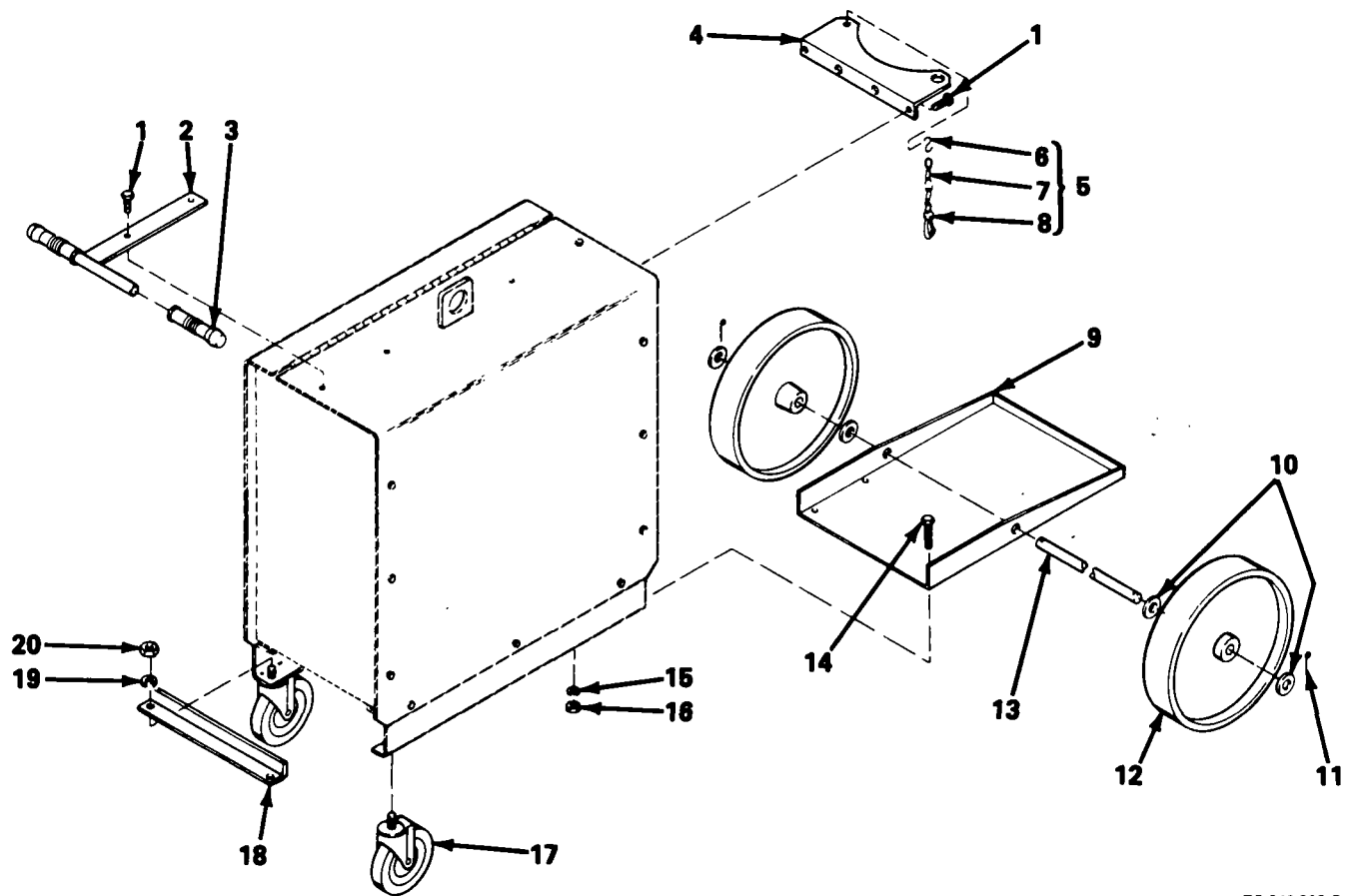
+ Not part of circuit card.

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Part Mkgs.	Description	Quantity
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Figure F Running Gear

1	108 940	SCREW, cap - hex flanged hd 1/4-20 x 3/4	4
2	025 193	HANDLE, running gear	1
3	604 423	GRIP, handle	2
4	057 478	BRACKET, support - tank	1
5	022 617	CHAIN, cylinder rack	1
6	602 389	. HOOK	1
7	602 387	. CHAIN	1
8	602 384	. SNAP	1
9	052 693	RACK, cylinder	1
10	602 250	WASHER, flat SAE 3/4 in	4
11	032 524	PIN, cotter 3/16 x 1-1/2	2
12	070 799	WHEEL, rubber, 3/4 bore 10 x 2-3/4	2
13	052 692	AXLE, running gear	1
14	601 944	SCREW, cap-hex hd 5/16-18 x 3/4	4
15	602 211	WASHER, lock-split 5/16	4
16	601 869	NUT, hex-jam 5/16-18	4
17	008 999	CASTER, swivel 4 inch dia	2
18	052 691	BAR, spreader cylinder rack	1
19	602 213	WASHER, lock-split 3/8	2
20	601 871	NUT, hex jam 3/8-16	2



TC-049 808-B

Figure F - Running Gear

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

